
BWSR Academy
October 28, 2010
Brainerd, MN
Brian Huberty
FWS National Wetlands Inventory Coordinator
Brian_huberty@fws.gov
Google

•Resource Inventory Background

•1980-82 B.S. U of MN–Natural Resource Inv.

•1982-84 MN DNR Forest Inventory

•1984-86 USGS EROS

•1986-89 M.S. U of MN – Remote Sensing/GIS

•1989-91 USFS Remote Sensing App. Center

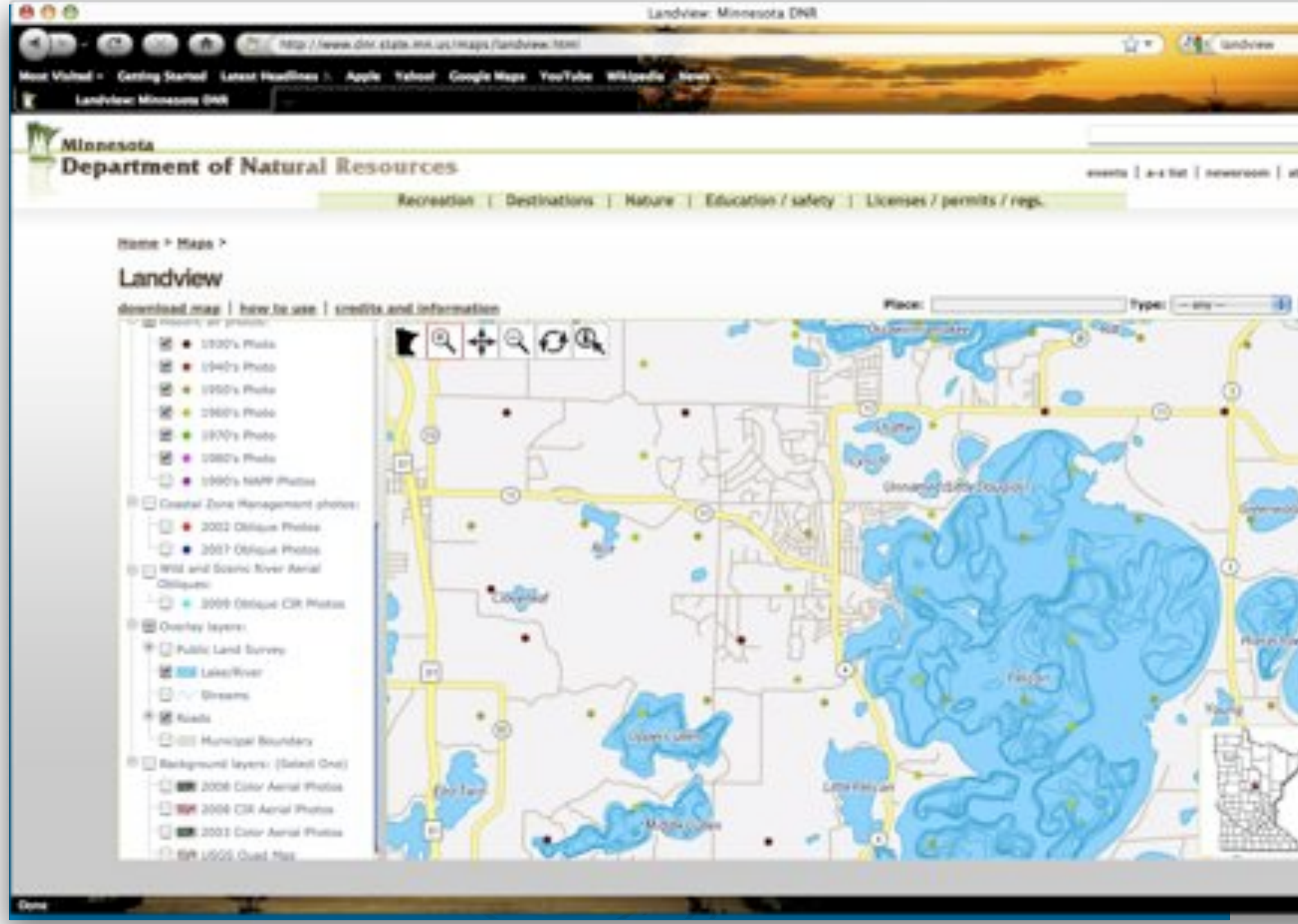
•1992-2002 USDA NRCS

•2002-2010 U.S. Fish & Wildlife Service


Let's Play
WHERE IS IT?
Bonus: Which Sensor?
Google


0-39
BXT-2


9-3-55


Landview: Minnesota DNR
Minnesota
Department of Natural Resources
Recreation | Destinations | Nature | Education / safety | Licenses / permits / regs.
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Place:
Type:


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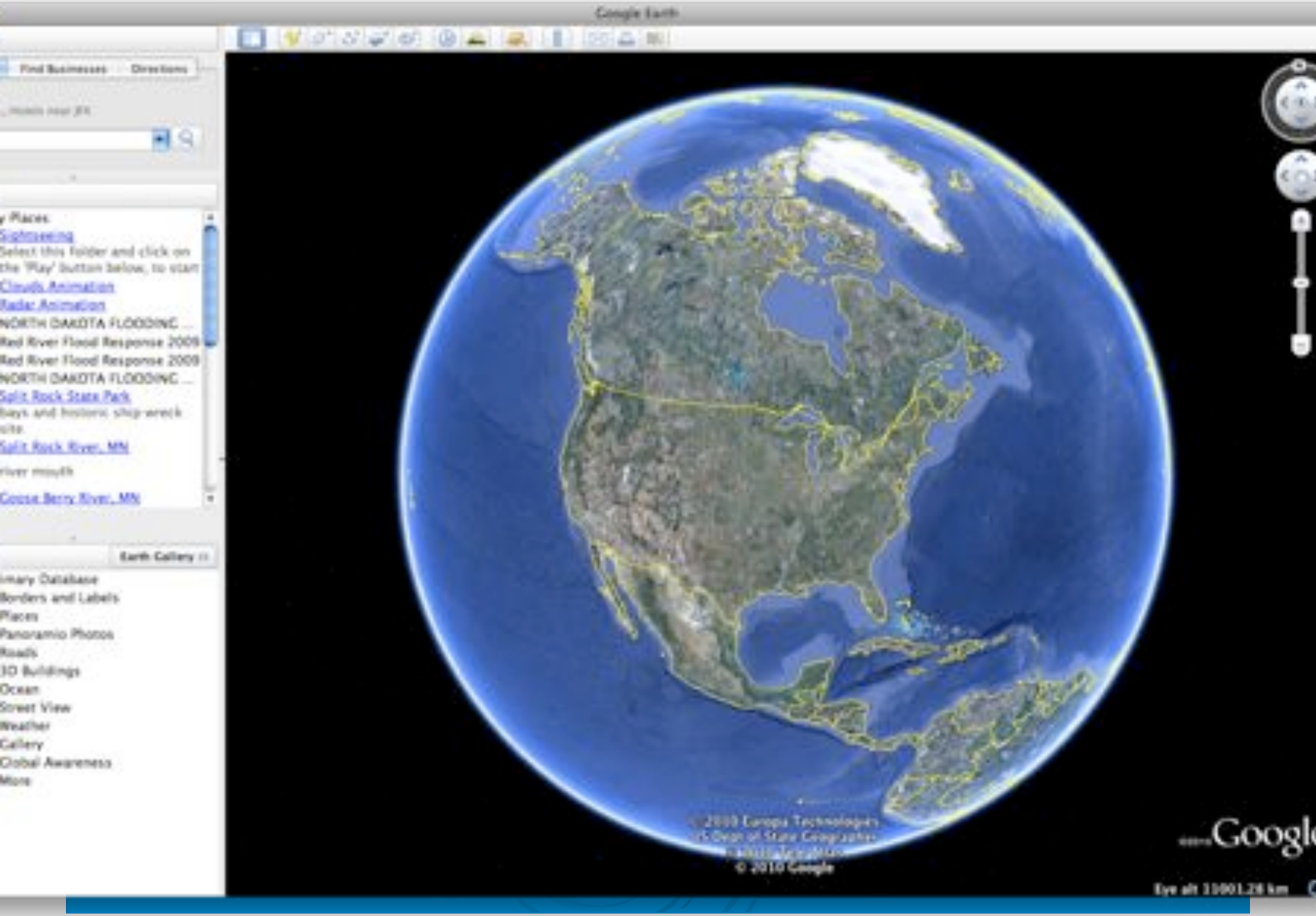
Google Earth
Find Businesses
Directions
Places
Sightseeing
Select this folder and click on the 'Play' button below, to start
Clouds Animation
Radar Animation
NORTH DAKOTA FLOODING
Red River Flood Response 2009
Red River Flood Response 2009
NORTH DAKOTA FLOODING
Split Rock State Park
Split Rock River, MN
Goose Berry River, MN
Earth Gallery
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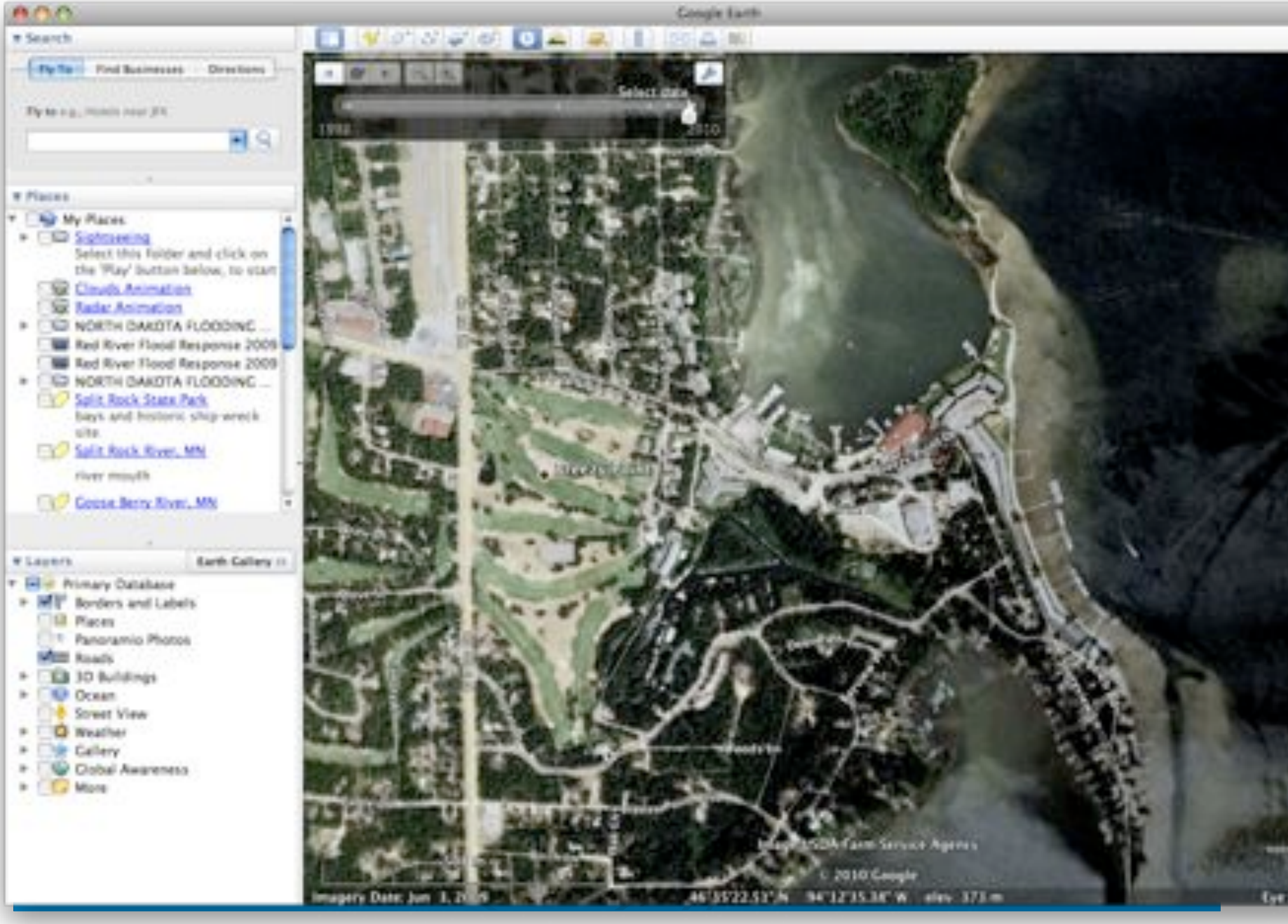
Eye alt 3100.28 km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Radar Animation
Red River Flood Response 2009
Red River Flood Response 2009
Split Rock State Park
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Layers
Earth Gallery
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Roads
3D Buildings
Ocean
Street View
Weather
Gallery
Global Awareness
More
Select date
1992
2010
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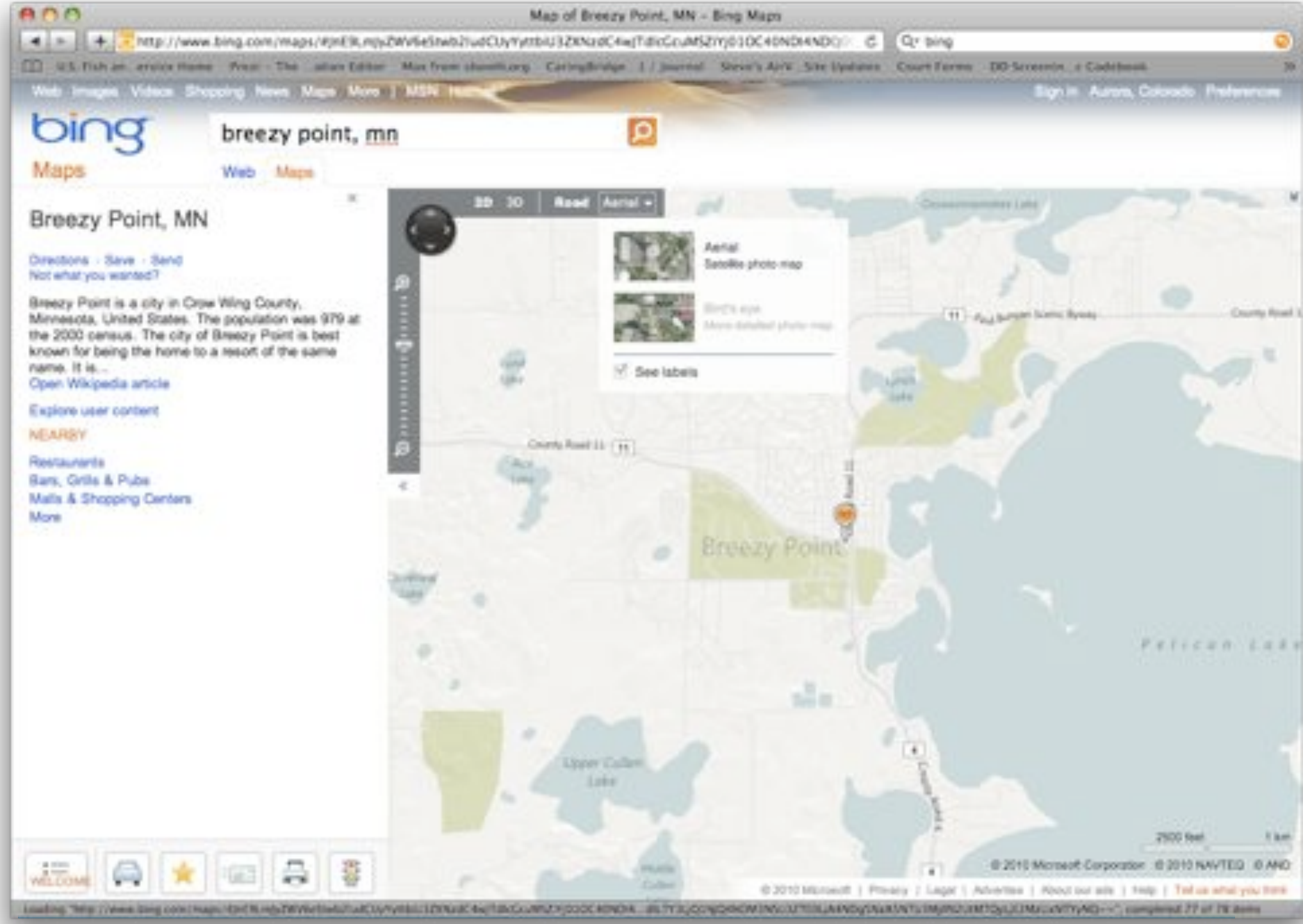
Map of Breezy Point, MN - Bing Maps
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Maps
breezy point, mn
Web
Maps
Breezy Point, MN
Directions · Save · Send
Not what you wanted?
Breezy Point is a city in Crow Wing County, Minnesota, United States. The population was 979 at the 2000 census. The city of Breezy Point is best known for being the home to a resort of the same name. It is...
Open Wikipedia article
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NEARBY
Restaurants
Bars, Grills & Pubs
Malls & Shopping Centers
More
3D
2D
Road
Aerial
Aerial
Satellite photo map
See labels
Breezy Point
Upper Cullen Lake
Pelican Lake
County Road 11
11
2500 feet
1 km
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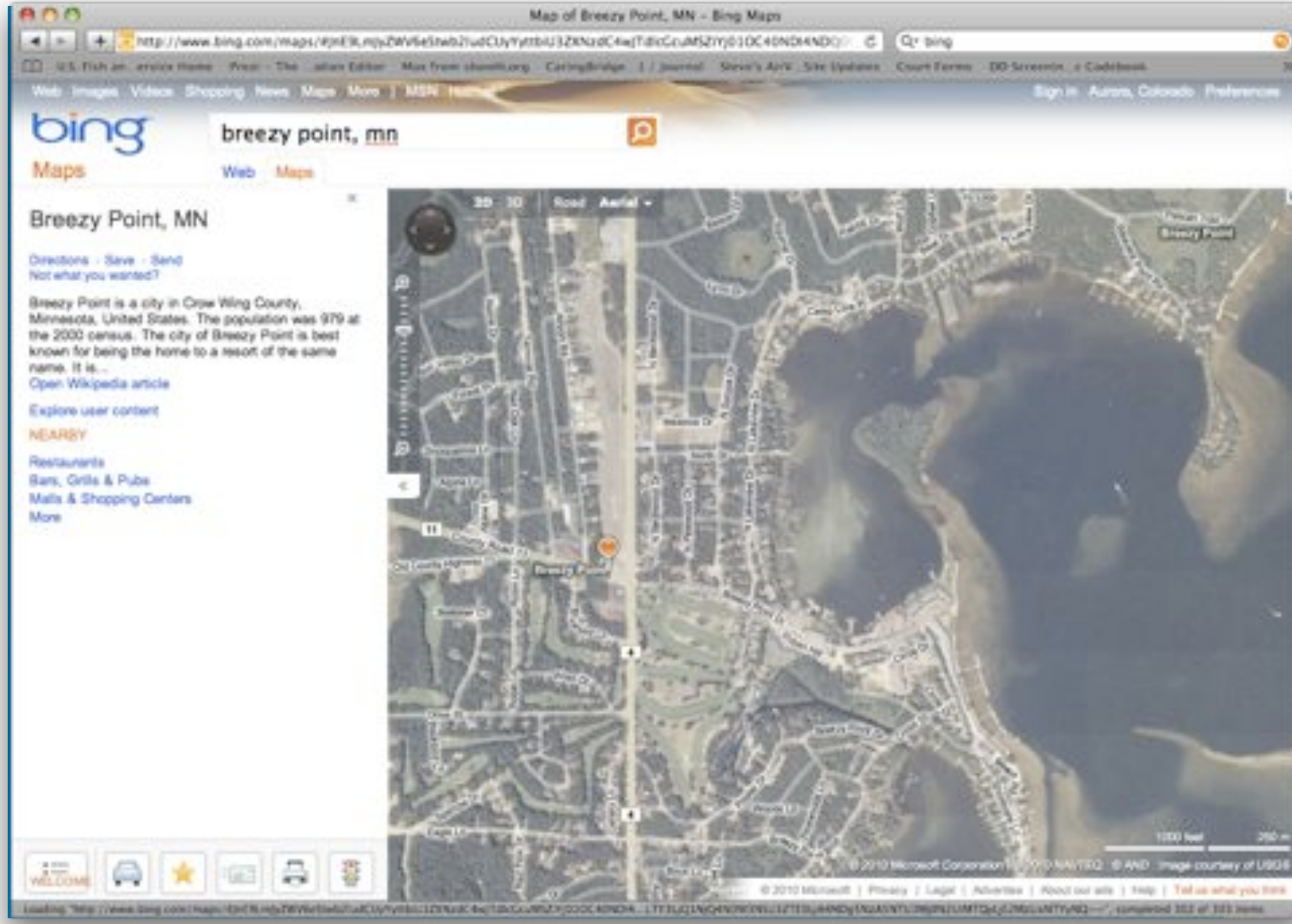
Map of Breezy Point, MN - Bing Maps
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Maps
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Open Wikipedia article
Explore user content
NEARBY
Restaurants
Bars, Grills & Pubs
Malls & Shopping Centers
More
Road
Aerial

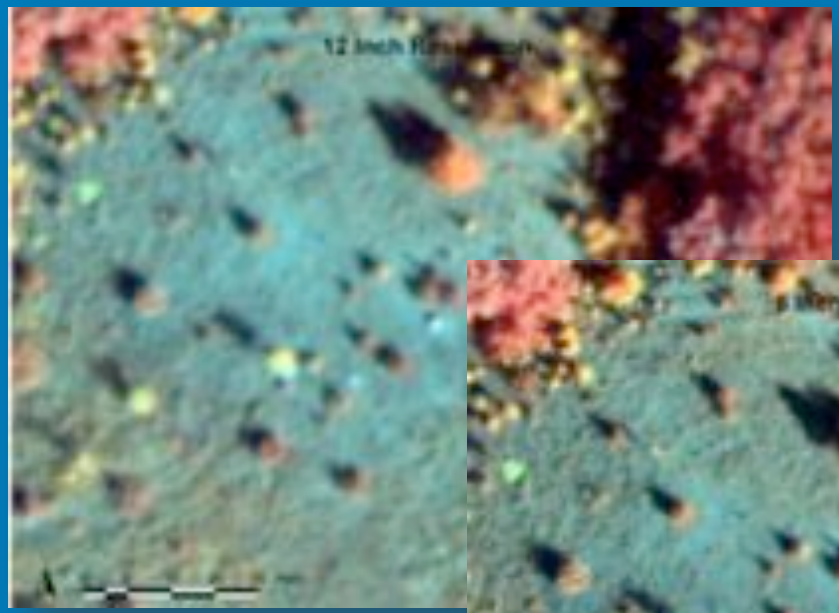
Remote Sensing Sources

- Optical Aerial Imagery
  - Old, New, Oblique
    - MN DNR
      - Landview - Historical
      - Resource Assessment – Fall CIR
      - Wetland Spring Leaf Off – NE MN/MSP
    - MN GEO
    - USDA
      - NAIP
      - Aerial Compliance Slides
    - USGS
    - MN DOT
    - County/City/Tribal
  - Multi-Spectral Imagery
  - Hyper-spectral Imagery

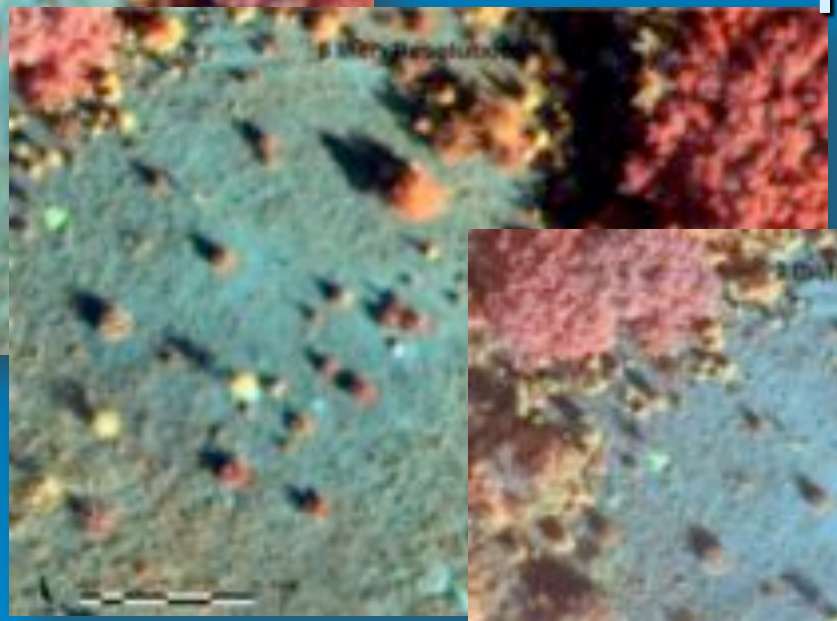
Overview

This technology can deliver 2" on ground pixel size resolutions and in color infrared.

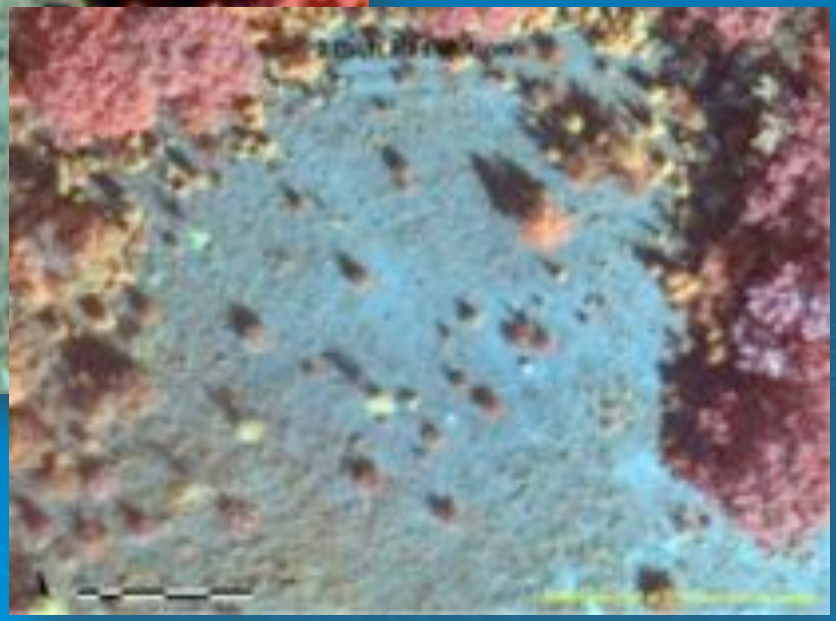
Head to Head Comparison



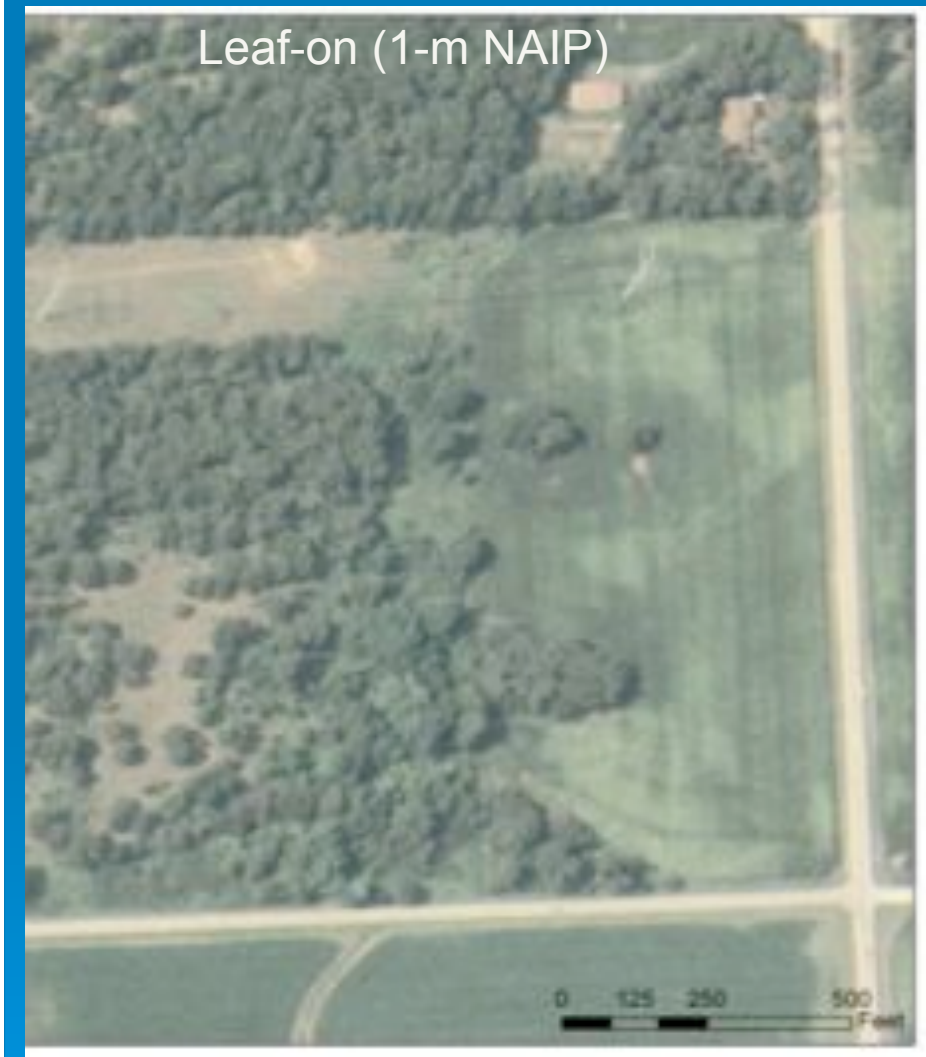
12” Resolution



6” Resolution



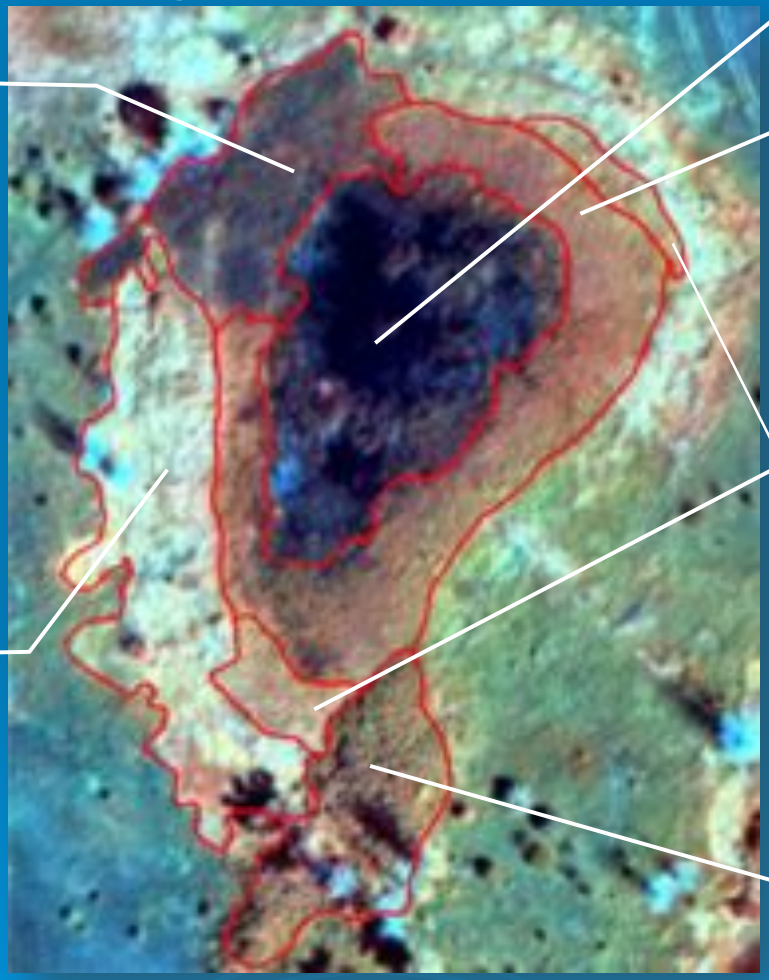
2” Resolution



Lacks distinction of vegetation types

Enables detection of honey suckle and buckthorn

Healthy Wetland:



Open Water – Diverse Aquatic Vegetation

Fen, Upwelling

Sedge Meadow

Cord Grass Stands

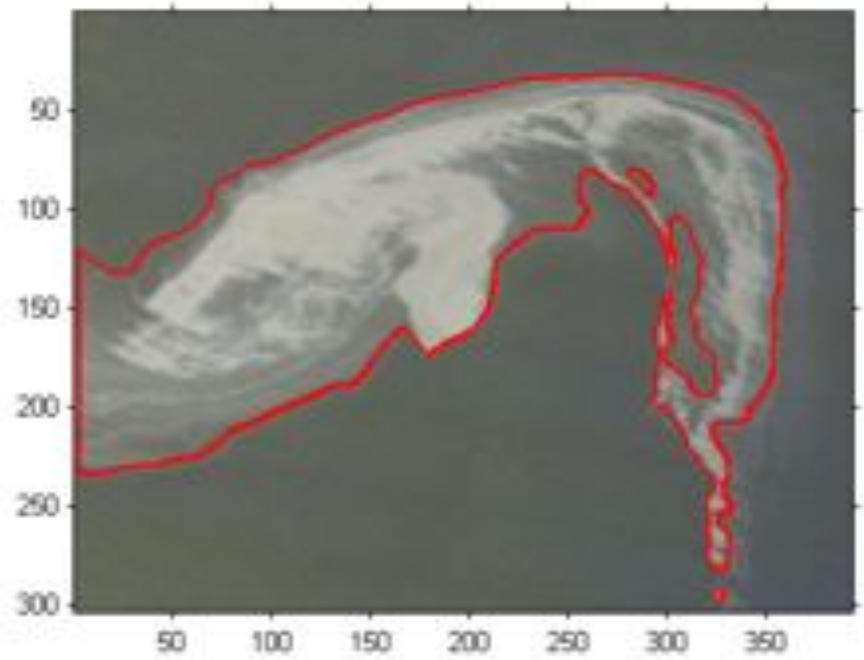
Cord Grass Stands

Sedge/Cord Grass

APPLIED ECOLOGICAL SERVICES, INC.

Vegetation Community Classes & Quality

REAL-TIME ORTHO DELIVERY


50
100
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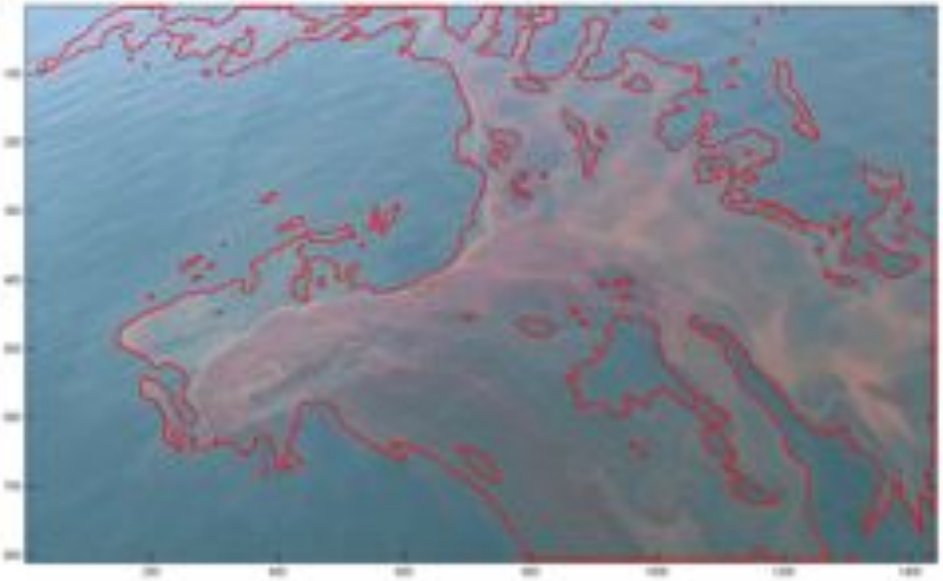


Remote Sensing Sources

- Optical Aerial Imagery
- Optical Satellite Imagery
- LIDAR – Terrestrial and Bathymetry
- Thermal Imagery
- Radar Imagery

SPOT 2010 Image Mosaic


LakeBrowser
http://water.umn.edu/cgi-bin/mapserv
Minnesota LakeBrowser
New: Check out the next generation Lakebrowser at LakesAndLand.umn.edu
LAKE DATA FOR 2005
1985
1990
1995
2000
2005
FIND A LAKE
(type lake name or ID)
Search Now!
Advanced Search
Statistical Summaries
Reference Map
Links:
Help Menu
Return to Water Resources
Go to the Twin Cities LakeBrowser for a wider range of dates for the metro area
Link to or bookmark the map
View state
Zoom in
Zoom out
Lake info
Print map
FOREGROUND
Water Clarity Depth
Rivers
Streams
Drainage Ditches
Major Roads
Redraw Map
BACKGROUND
Land Cover
Urban
Crop & Grassland
Shrubland
Aquatic Environment
Forest
EPA Ecoregions
N. Minnesota wetland
Red River Valley
N. Glaciated Plain
N. Lakes & Forests
N.C. Hardwood
W. Corn Belt Plains
Driftless Area
Shaded Relief
Aerial Photographs

Minnesota LakeBrowser

New! Check out the next generation Lakebrowser at LakesAndLand.umn.edu

LAKE DATA FOR 2005

1985 1990 1995 2000 2005

FIND A LAKE
(type lake name or ID)

Search Now!

Advanced Search

Statistical Summaries

Reference Map

Links:

- Help Menu
- Return to Water Resources
- Go to the Twin Cities LakeBrowser for a wider range of

View state | Zoom in | Zoom out | Lake info | Print map

FOREGROUND

- Water Clarity Depth
  - > 1.5 ft — > 0.5 m
  - 1.5-3 ft — 0.5-1 m
  - 3-6 ft — 1-2 m
  - 6-12 ft — 2-4 m
  - > 12 ft — > 4 m
- Rivers
- Streams
- Drainage Ditches
- Major Roads
- Redraw Map

BACKGROUND

- Land Cover
  - Urban
  - Crop & Grassland
  - Shrubland
  - Aquatic Environment
  - Forest
- EPA Ecoregions
  - N. Minnesota wetland
  - Red River Valley
  - N. Glaciated Plain
  - N. Lakes & Forests
  - N.C. Hardwood

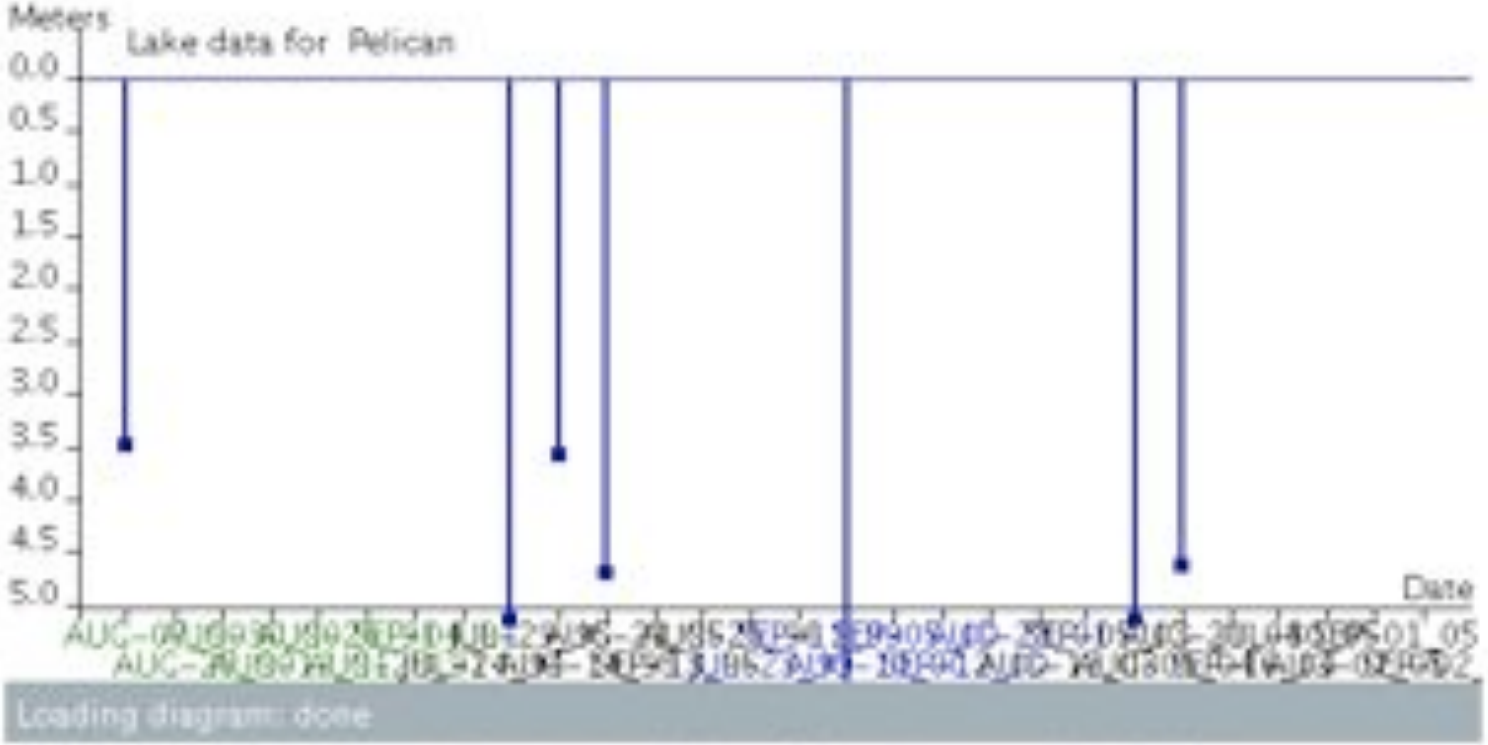
Minnesota LakeBrowser

Pelican

(Lake ID: 18030800)

1990 Clarity Depth Average: 3.49 m
1995 Clarity Depth Average: 4.48 m
2000 Clarity Depth Average: 6.08 m
2005 Clarity Depth Average: 4.90 m

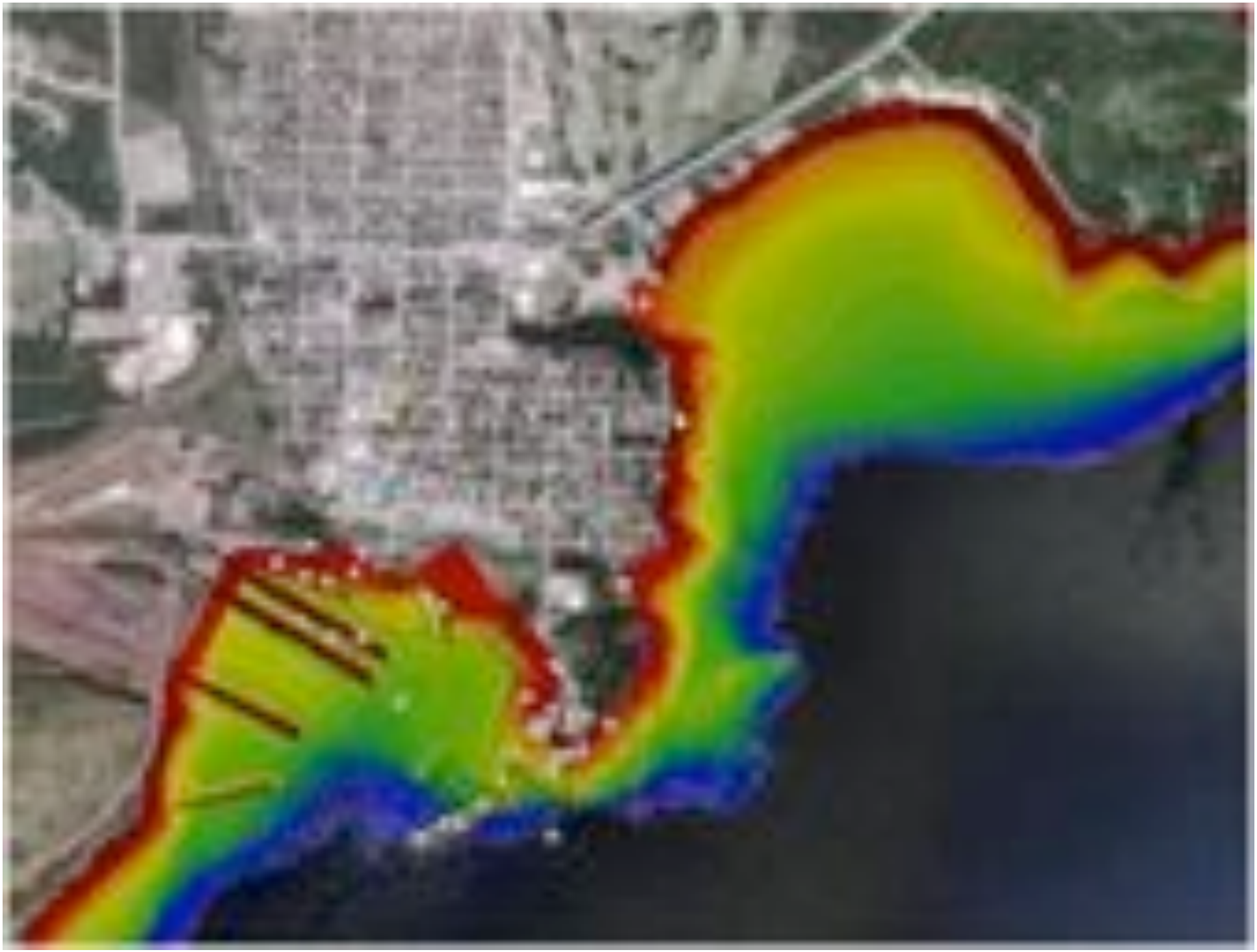
These averages were calculated from the following dates of satellite imagery:



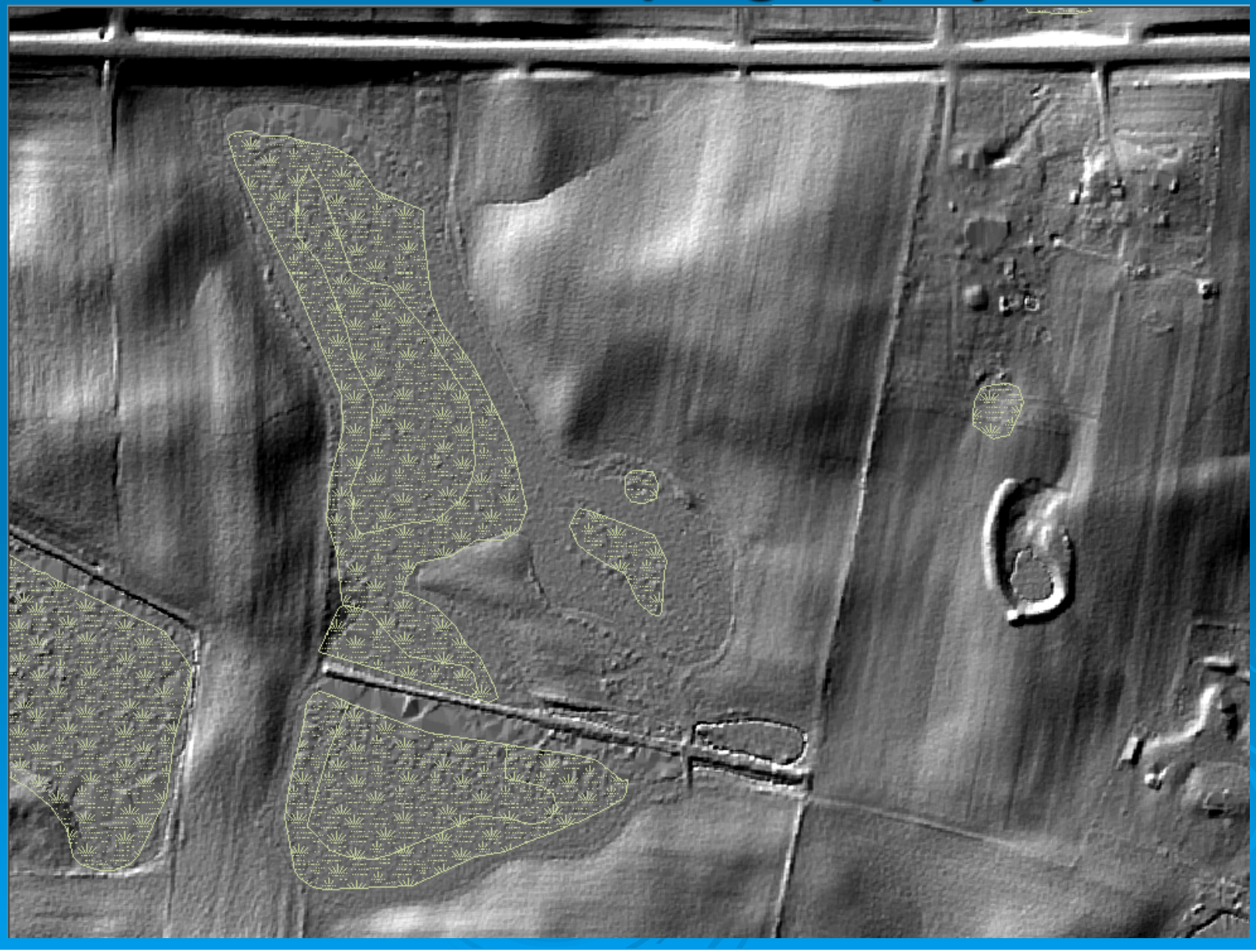
View more information about Pelican from Minnesota DNR/PCA

Learn more about remote sensing of water resources

print close

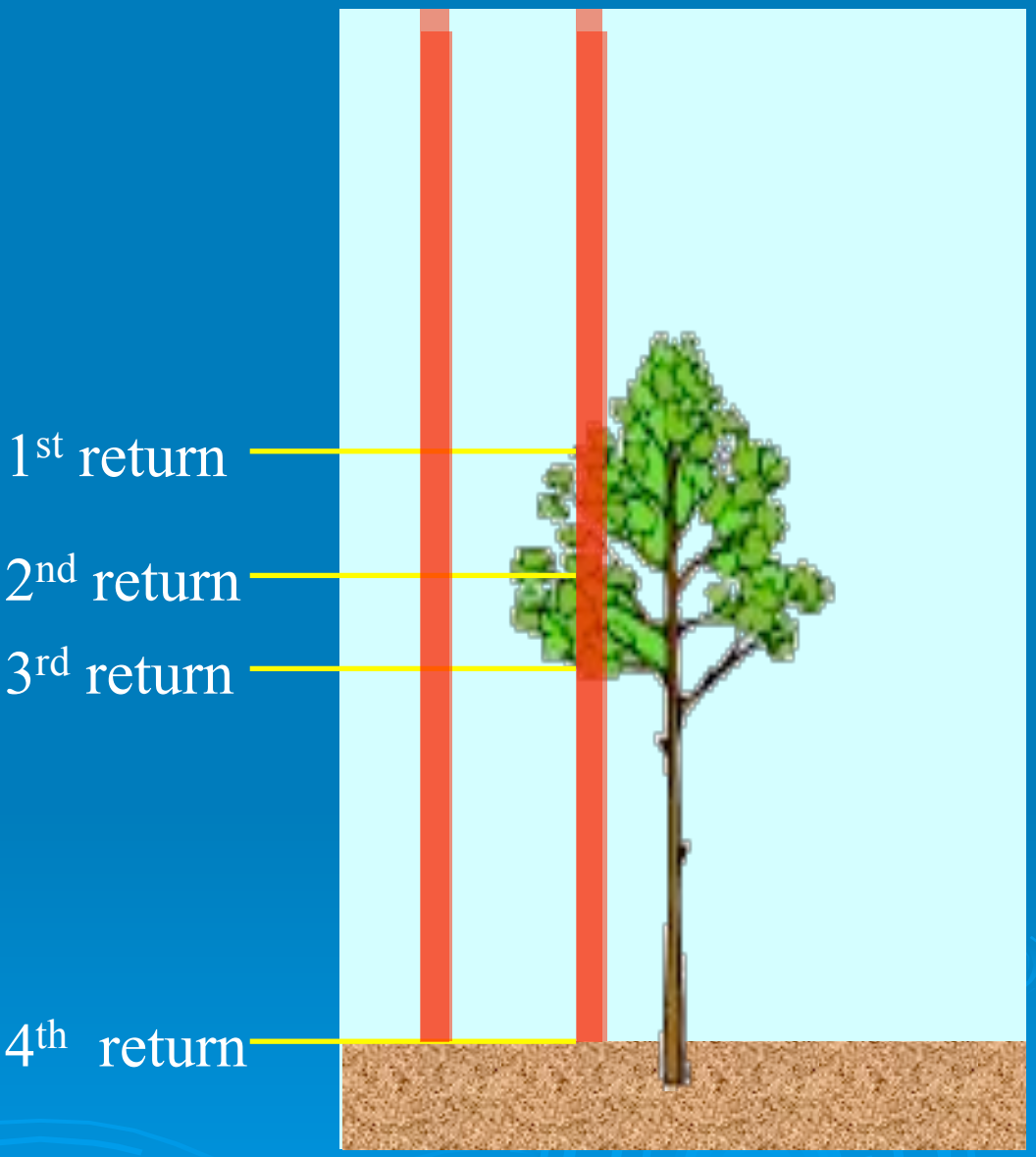


LiDAR Topography

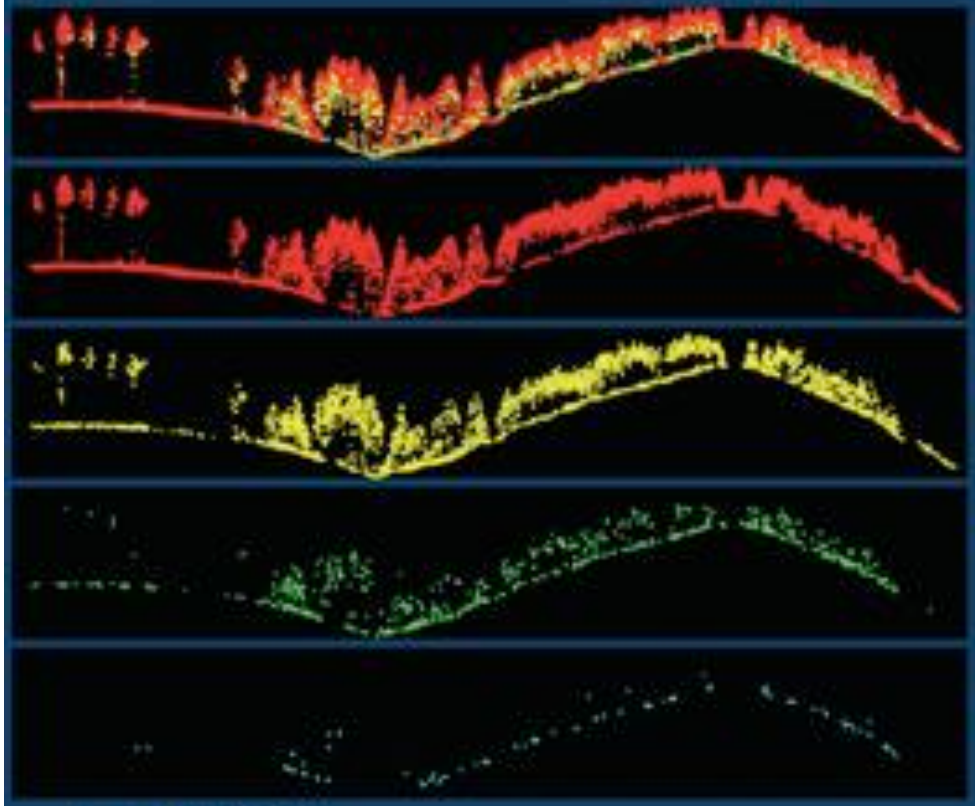


Returns

- Single Return
- Multiple returns
- Waveform Returns



Multiple Return lidar systems



All returns (16,664 pulses)

1st returns

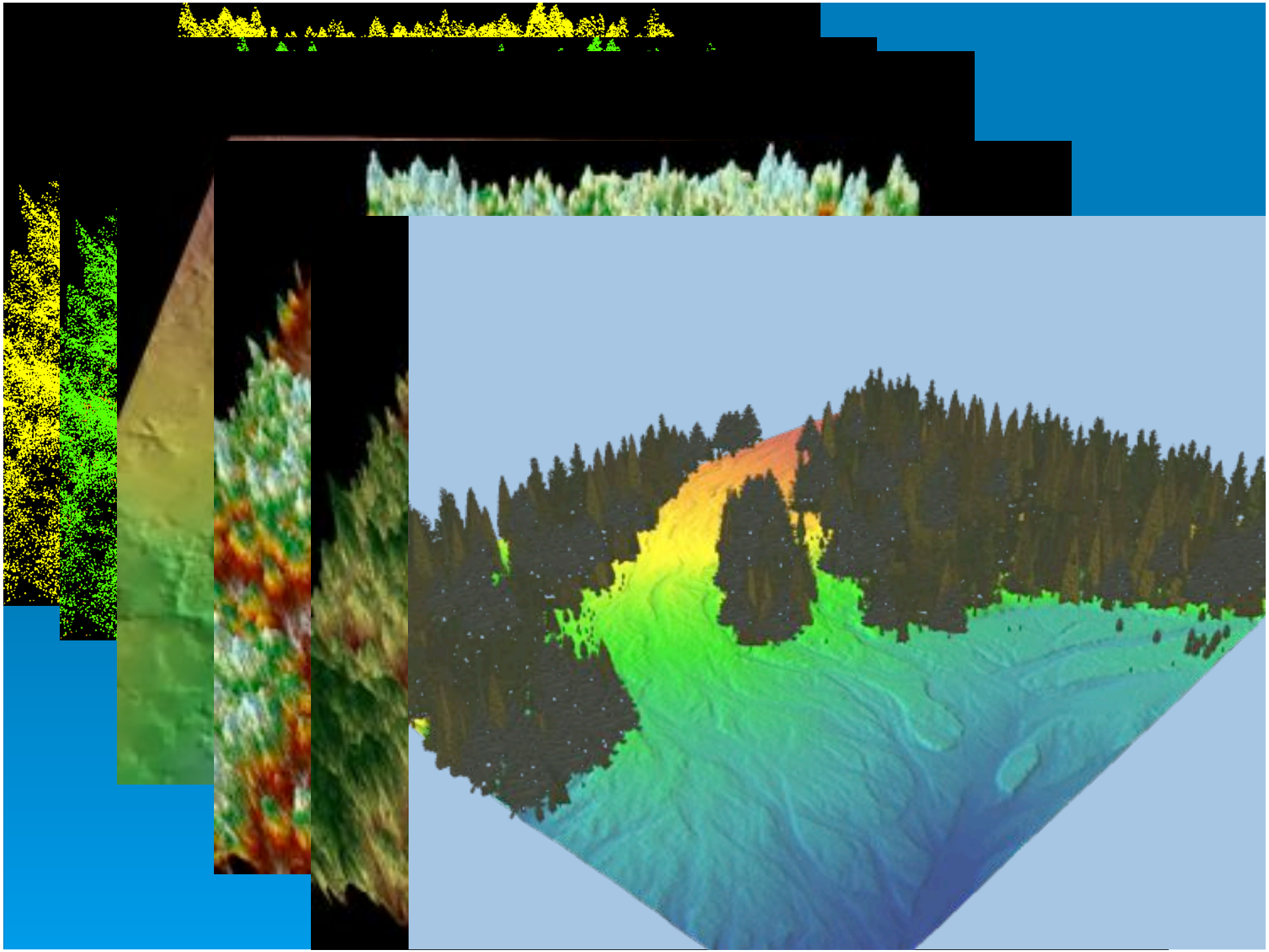
2nd returns (4,385 pulses, 26%)

3rd returns (736 pulses, 4%)

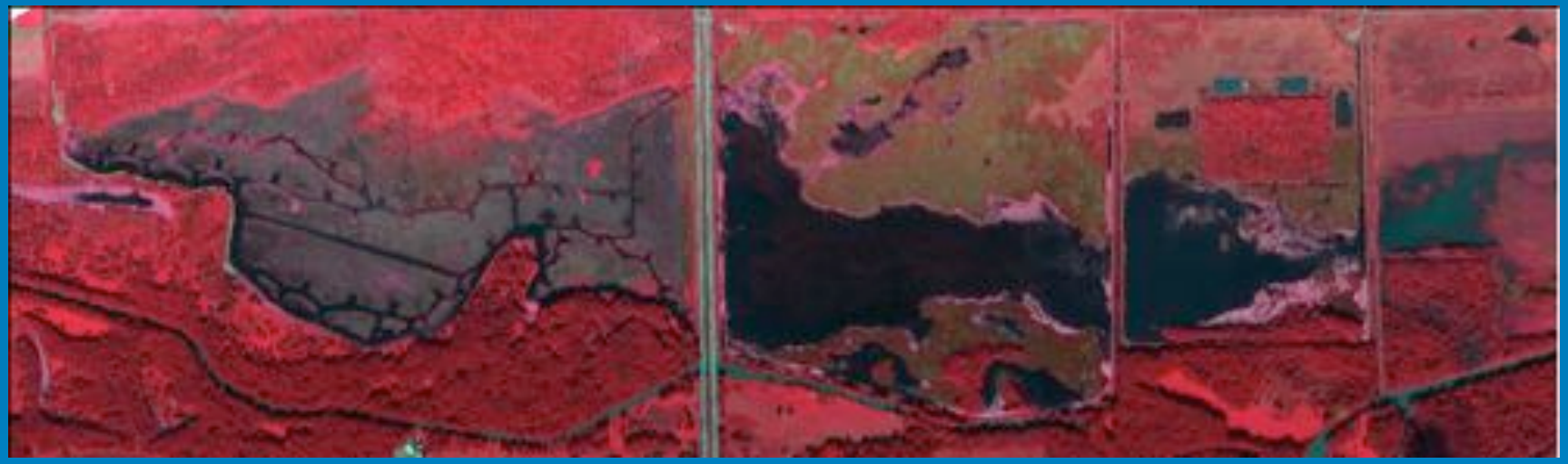
4th returns (83 pulses, <1%)

USGS

Image courtesy Hans-Erik Anderson



Study Area Color Infrared



15, September 2006 13:50

20060915_MR1

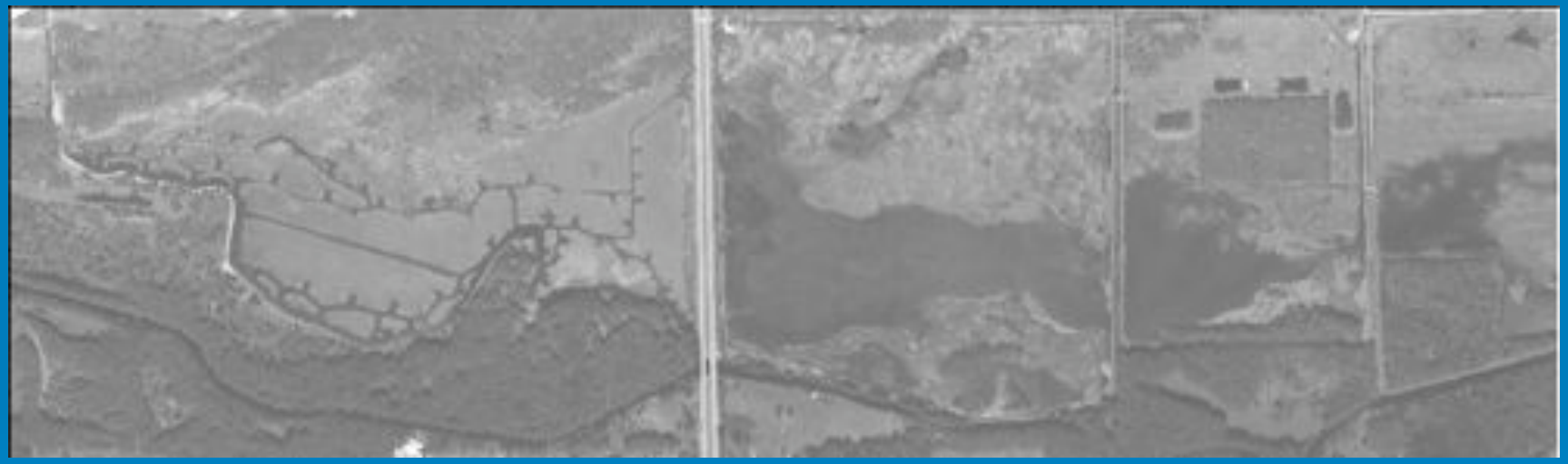
RGB

Red: Band 12 (0.82)

Green: Band 09 (0.67)

Blue: Band 05 (0.55)

Daytime Thermal



Day B15 (4.533)

15, September 2006 13:50

Value

High : 38.0435

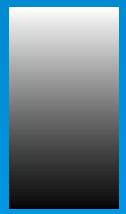
Low : 0

Nighttime Thermal

Night B15 (4.533)

14, September 2006 00:26

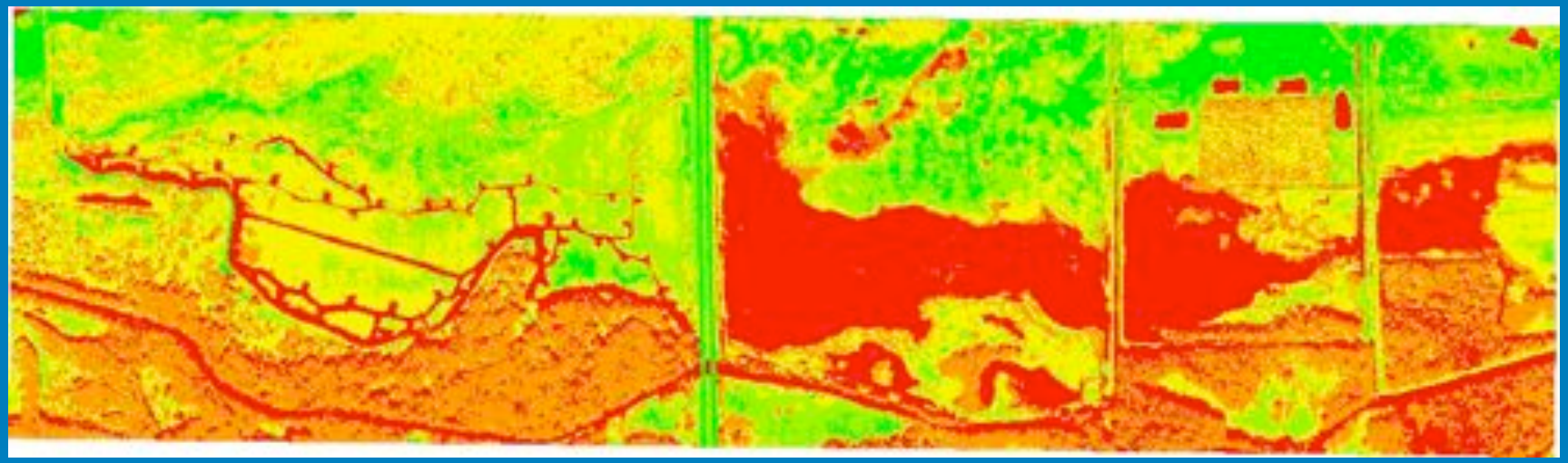
Value



High : 16.5515

Low : 0

Diurnal Ratio

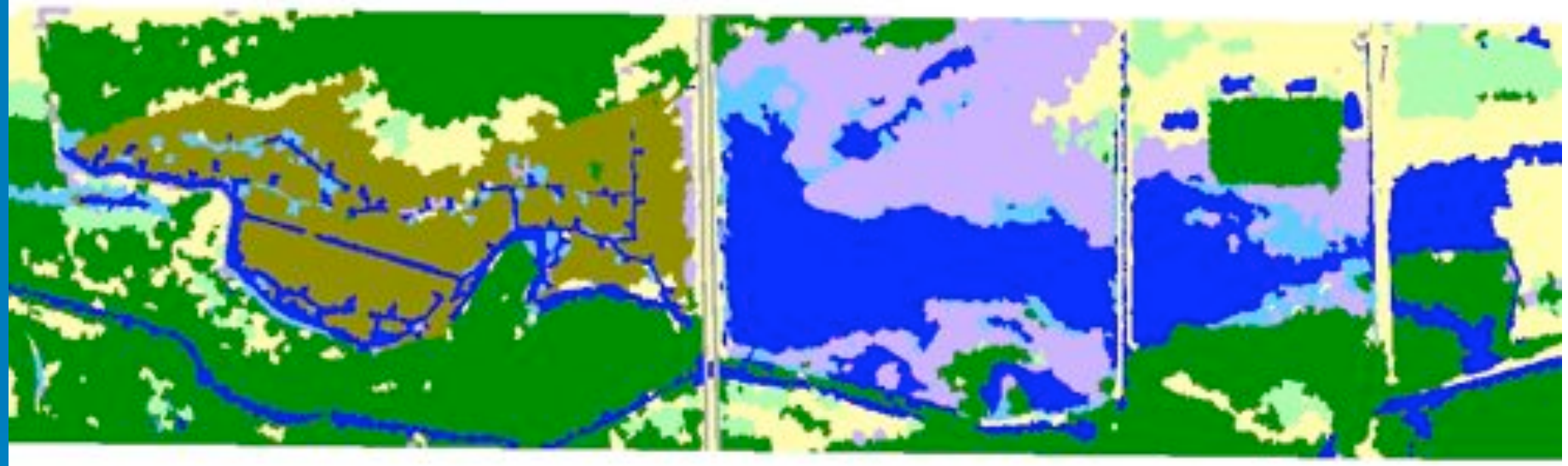


Day/Night Ratio

- 0 - 1.2
- 1.2 - 1.3
- 1.3 - 1.5
- 1.5 - 1.7
- 1.7 - 3.1

(Band 15 Day / Band 15 Night)

Classification Result

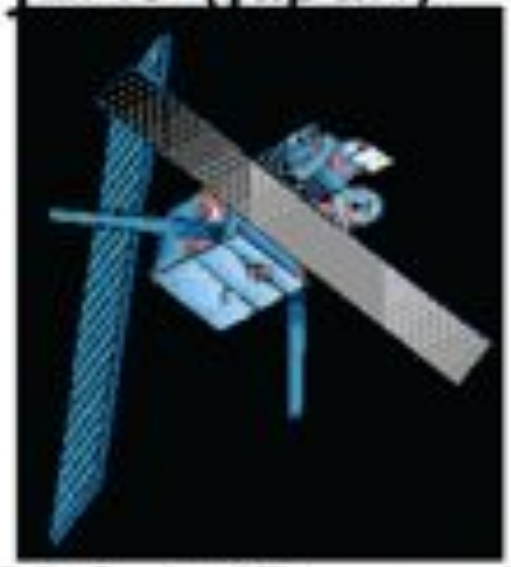


Land Use Land Cover

- Deciduous Forest
- Herbaceous Openland
- Aquatic Bed Wetlands
- Mud Flats
- Road
- Shrubland
- Emergent Wetlandsr
- Water

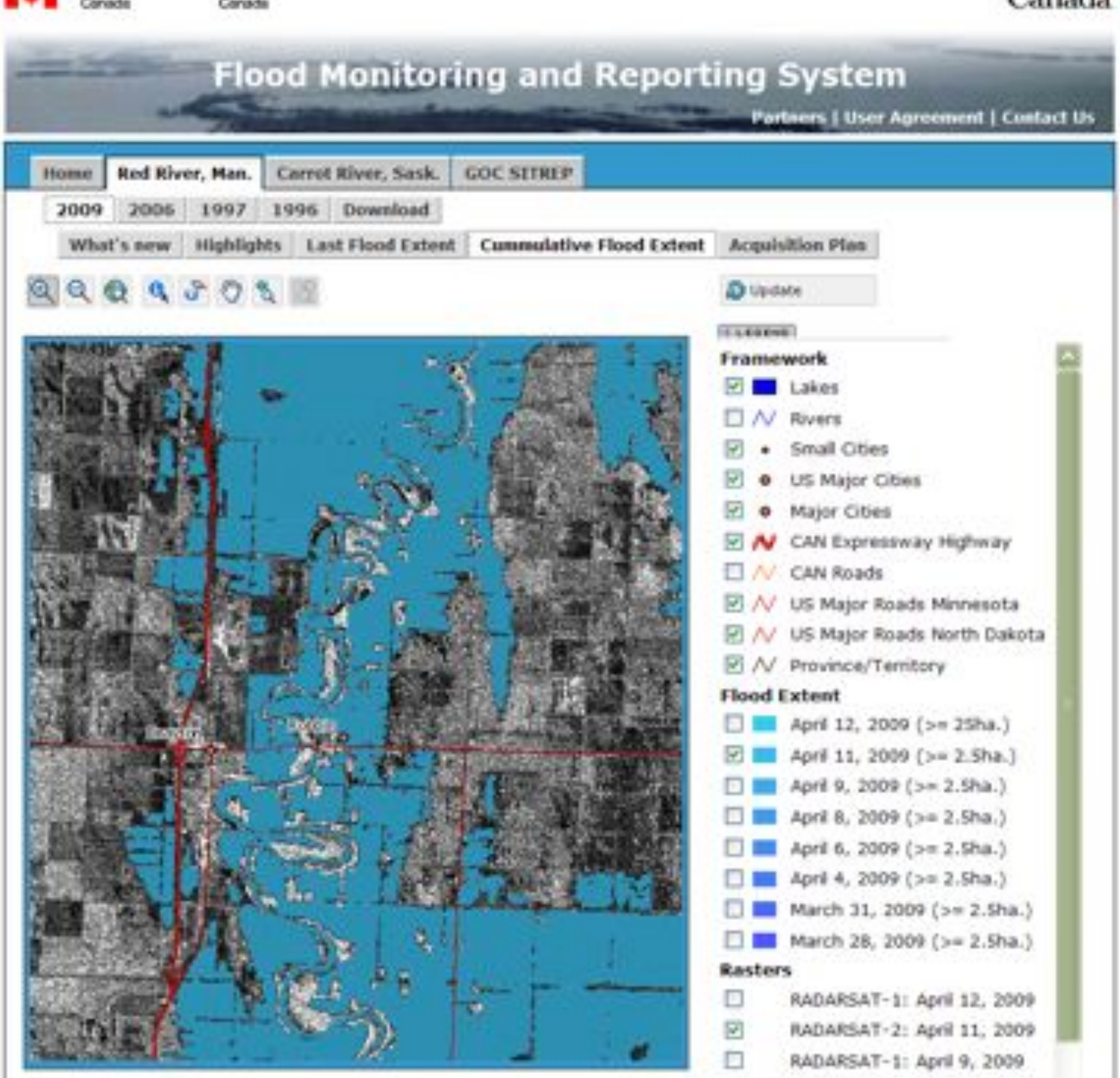
JERS (Japan)

Radarsat (Canada)



ERS-1 (Europe)

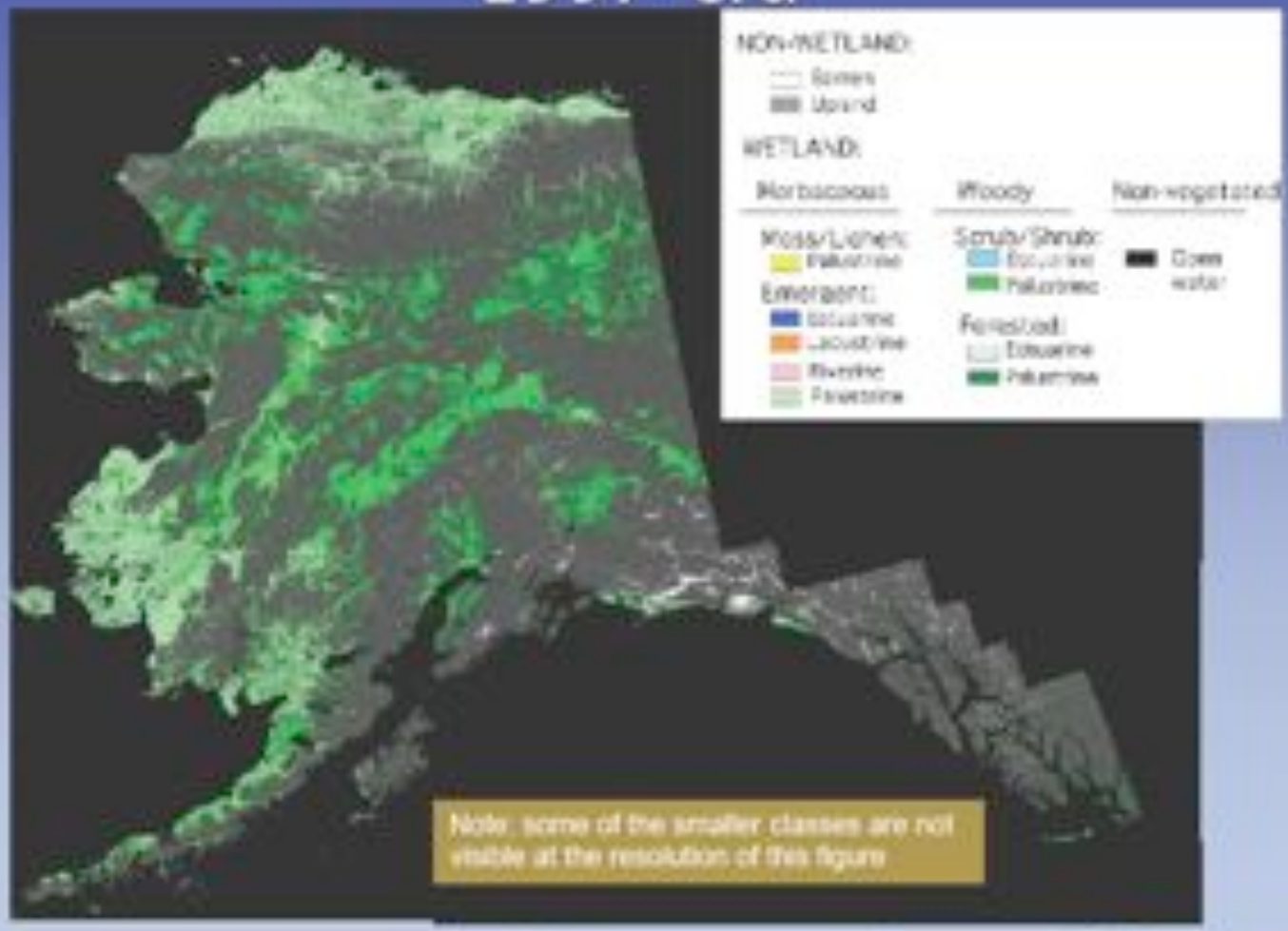
Envisat (Europe)


Canada
Canada
Flood Monitoring and Reporting System
Partners | User Agreement | Contact Us
Home
Red River, Man.
Carrot River, Sask.
GOC SITREP
2009
2006
1997
1996
Download
What's new
Highlights
Last Flood Extent
Cummulative Flood Extent
Acquisition Plan
Update
Framework
Lakes
Rivers
Small Cities
US Major Cities
Major Cities
CAN Expressway Highway
CAN Roads
US Major Roads Minnesota
US Major Roads North Dakota
Province/Territory
Flood Extent
April 12, 2009 (>= 25ha.)
April 11, 2009 (>= 2.5ha.)
April 9, 2009 (>= 2.5ha.)
April 8, 2009 (>= 2.5ha.)
April 6, 2009 (>= 2.5ha.)
April 4, 2009 (>= 2.5ha.)
March 31, 2009 (>= 2.5ha.)
March 28, 2009 (>= 2.5ha.)
Rasters
RADARSAT-1: April 12, 2009
RADARSAT-2: April 11, 2009
RADARSAT-1: April 9, 2009

2008 - All of Alaskan Wetlands were mapped using JERS Radar Images

- Part of larger NASA/U of MI Climate Change study
- 85% Accurate as compared to 5 different NWI classes.
- Used summer & winter images
- Demonstrated the use of Radar
- Total estimated cost of around $5 million

Completed Wetlands Map of Alaska, 1997-era



Great Lakes Restoration Initiative – GLRI – Remote Sensing Projects

University of Minnesota

- Led by Dr Joe Knight
- Jennifer Corcoran – PhD Student
- RANDOM FORESTS – Wetland Prediction
  - RADAR Images
  - Aerial Images
  - NWI
  - SSURGO
  - LIDAR

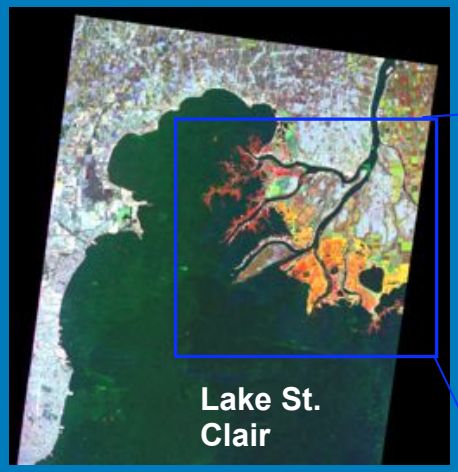
Michigan Tech Research Institute & University of Minnesota

- Invasives mapping – Phrag.
  - More accurate than hyperspectral
- Wetland change detection
- Vegetation Structure Mapping
- Improved wetland extent delineations
- More rapid response for climate change

MTRI mapping phragmites for *entire* Great Lakes Shoreline

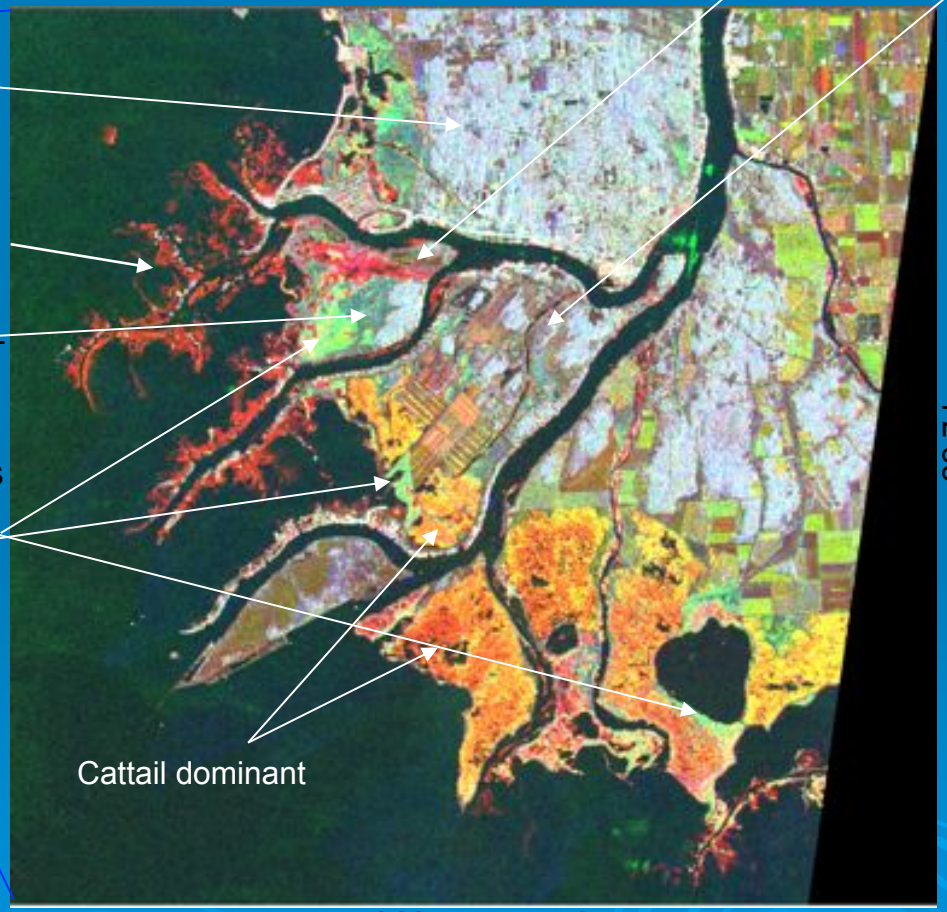
Current Known Distribution of Common Reed (Phragmites australis)

SAR Multi-Sensor Composite of *Lake St. Clair*



Multi-sensor L- and C-band radar composite depicts the biomass and flooding differences between the various emergent wetlands in this delta

- Radarsat Oct 98
- JERS August 98
- JERS March 95



Ref: L Chavez, MTRI

Wetland Hybrid Change Detection

Ref: L Chavez, MTRI

2.6% overall change to 9 counties (UP, Mac and Leelenau)

wetland to upland
2546 hectares (ha)

upland to wetland
3 ha.

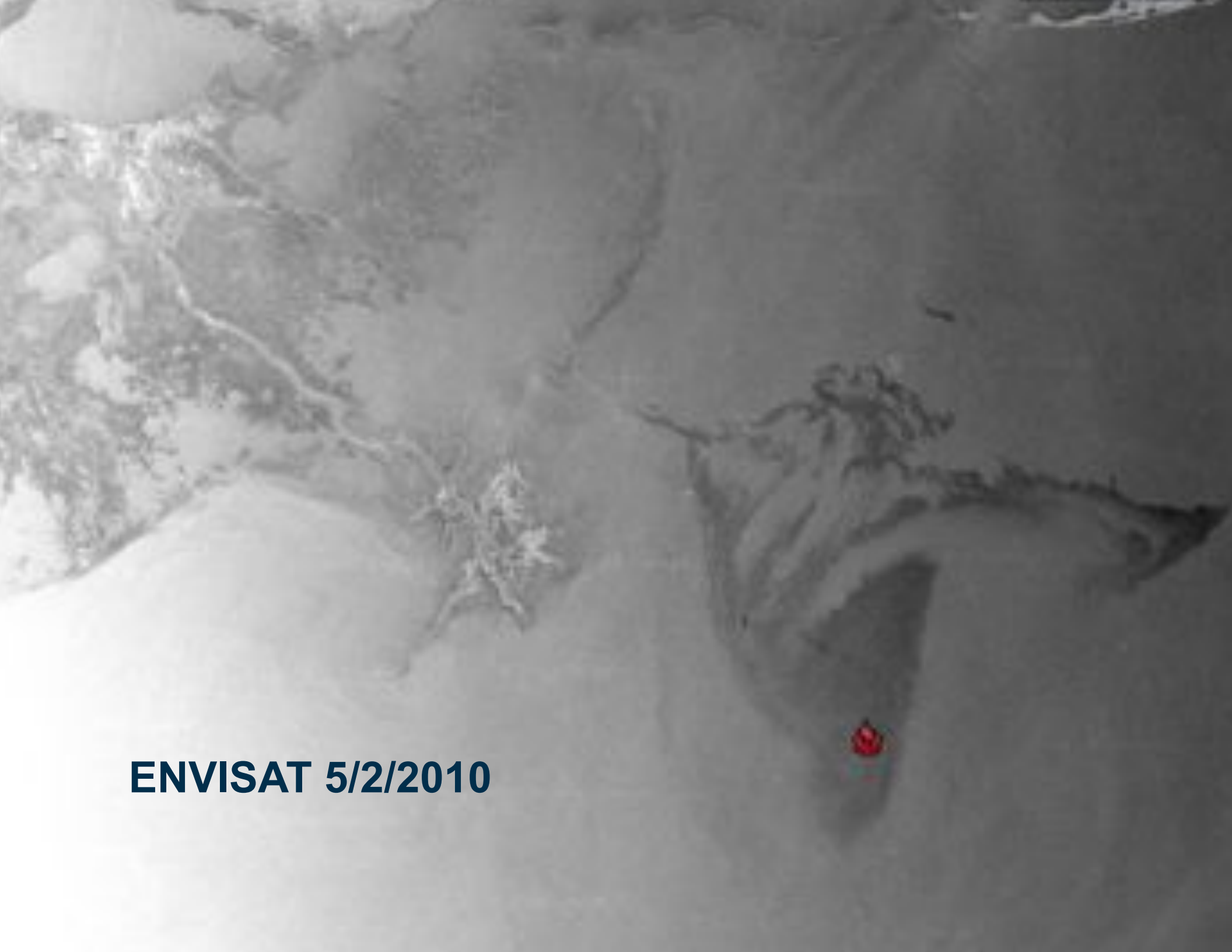
emergent to woody wetland
1304 ha

woody to emergent
7.2 ha

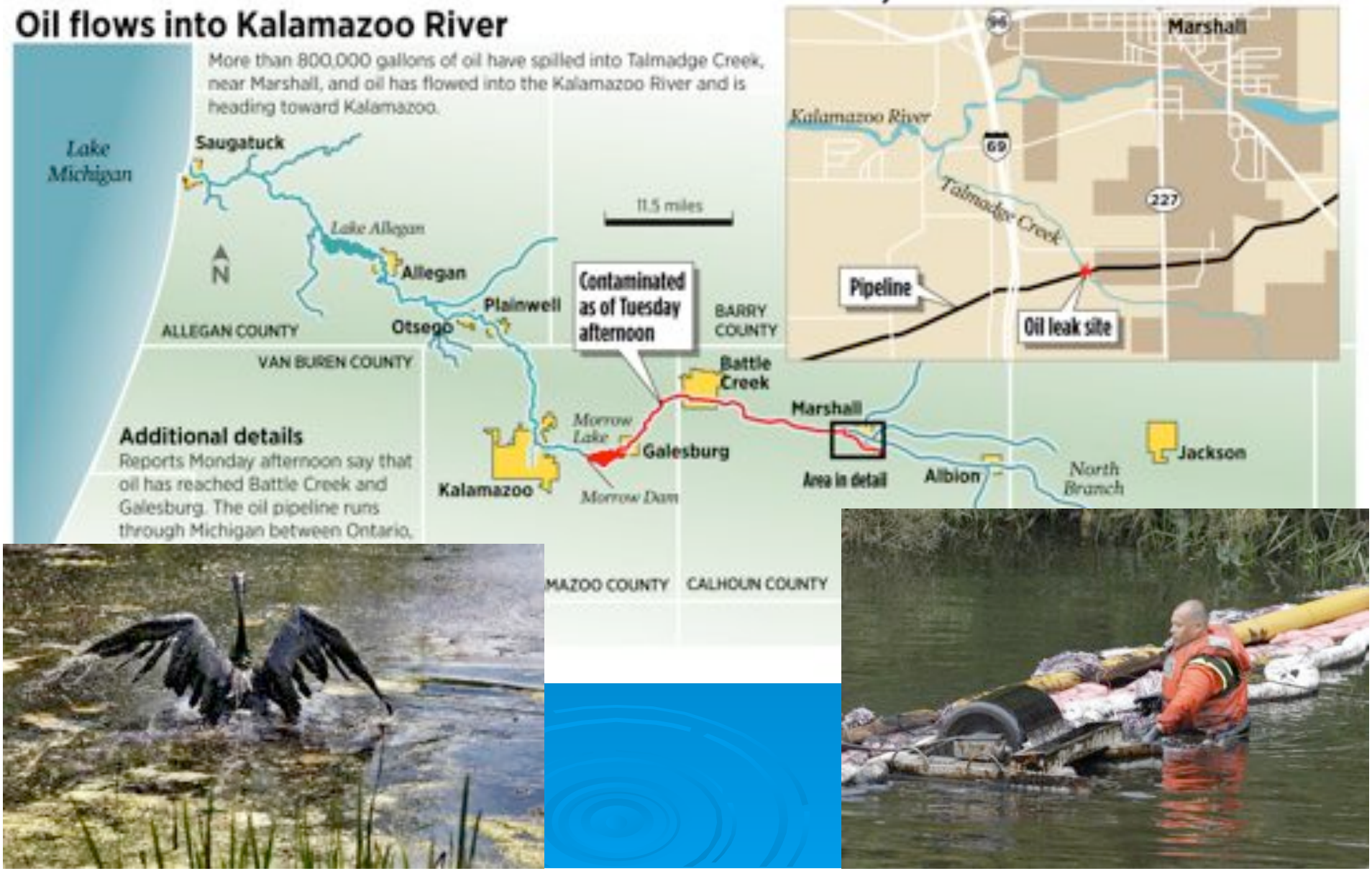
wetland to open water (including aquatic bed)
124 ha.

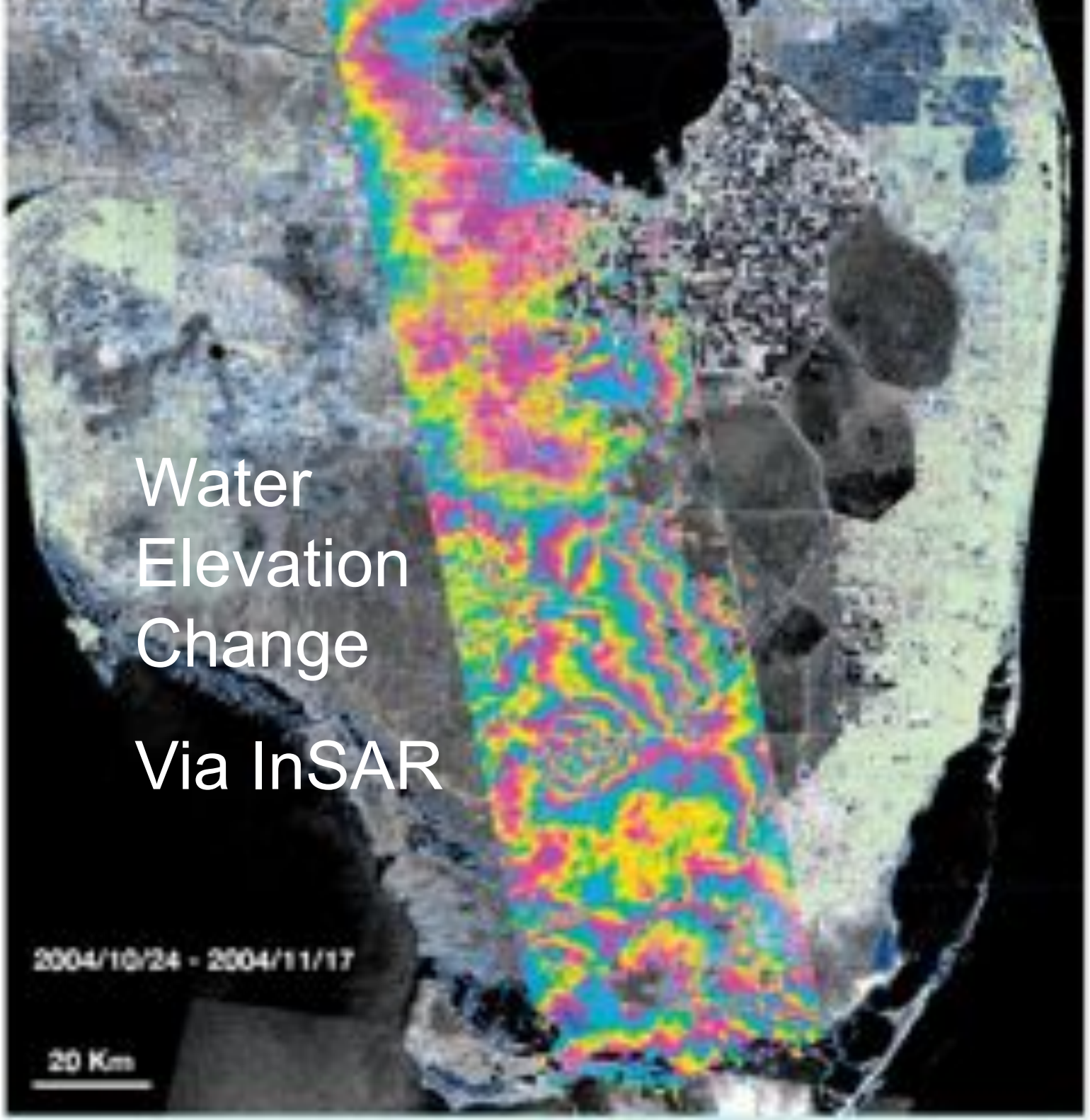
So what does radar imaging mean for wetlands?

- map *all* of North American wetlands in a month or so,
- map water elevation change in wetlands,
- map some invasive species better than optical systems.
- And oil spills?


ENVISAT 5/2/2010

2010 July 26 Michigan Oil Spill
One Million Gallons – 20,000 Barrels

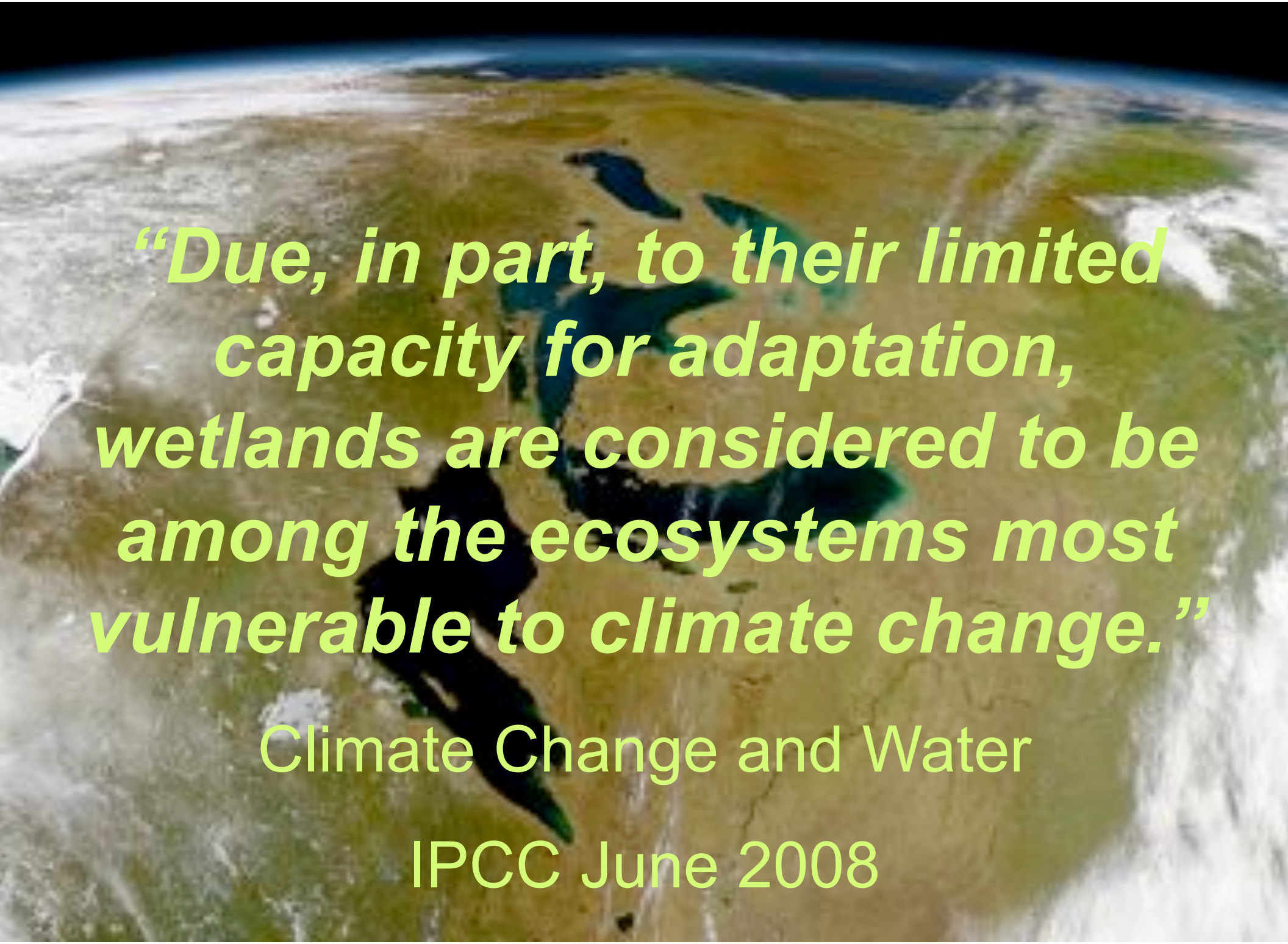


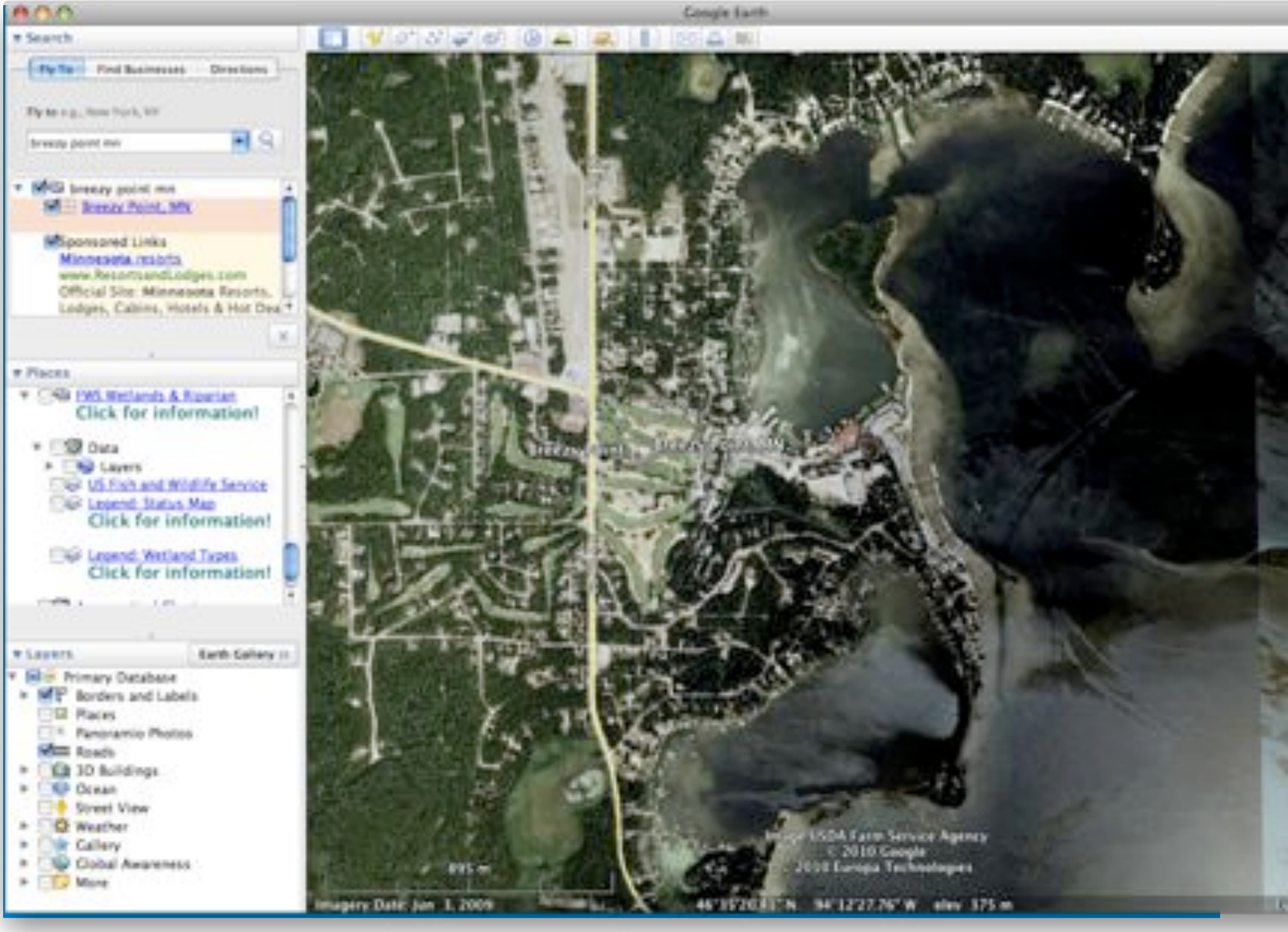

Water
Elevation
Change
Via InSAR
2004/10/24 - 2004/11/17
20 Km

Wetland Maps for the Future

CLIMATE CHANGE AND WATER

IPCC Technical Paper VI


"Due, in part, to their limited capacity for adaptation, wetlands are considered to be among the ecosystems most vulnerable to climate change."
Climate Change and Water
IPCC June 2008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breezy point mn
Breezy Point, MN
Sponsored Links
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www.ResortsandLodges.com
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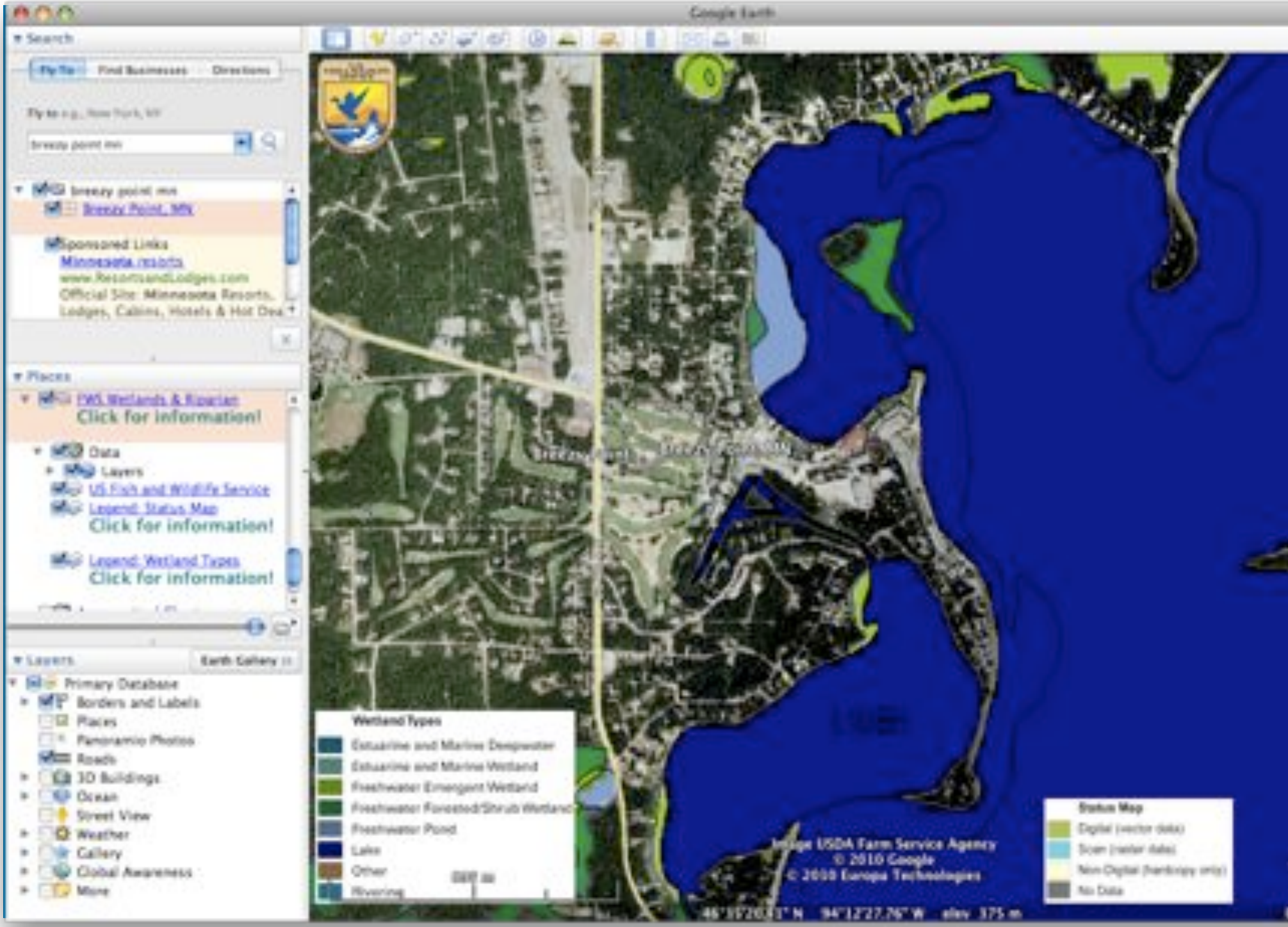
DNR Wetlands & Riparian
Click for information!
Data
Layers
US Fish and Wildlife Service
Legend: Status Map
Click for information!
Legend: Wetland Types
Click for information!
Layers
Earth Gallery
Primary Database
Borders and Labels
Places
Panoramio Photos
Roads
3D Buildings
Ocean
Street View
Weather
Gallery
Global Awareness
More
895 m
Image USDA Farm Service Agency
© 2010 Google
2010 Europa Technologies
Imagery Date: Jun 1, 2009
46°35'20.83" N 94°12'27.76" W elev 375 m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Wetland Types
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Estuarine and Marine Wetland
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Other
Riverine
Status Map
Digital (vector data)
Scan (raster data)
Non-Digital (hardcopy only)
No Data
Image USDA Farm Service Agency
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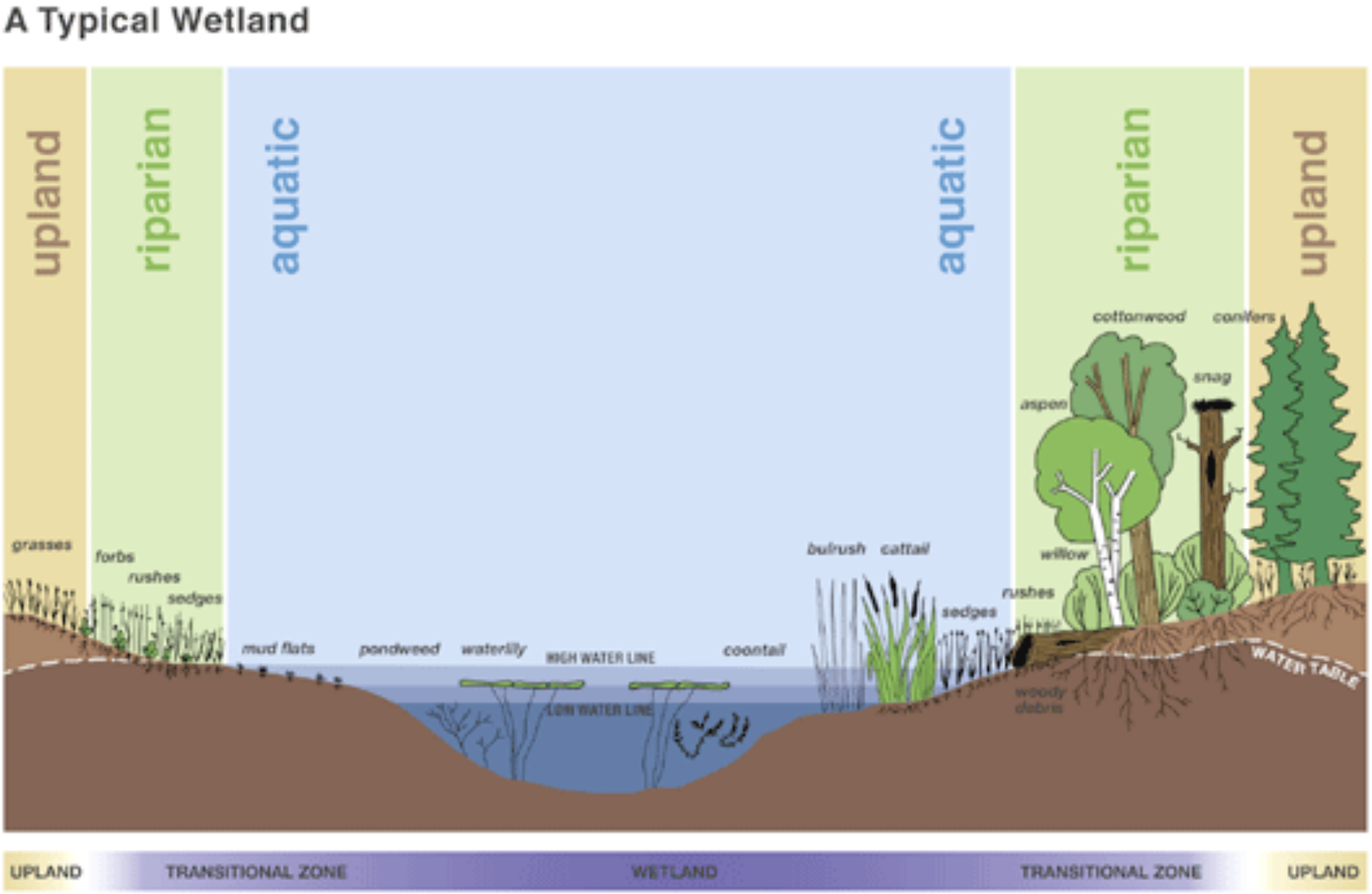
Existing NWI data is
- out-of-date
= 2-Dimensional

Agricultural Drainage

Urban Development

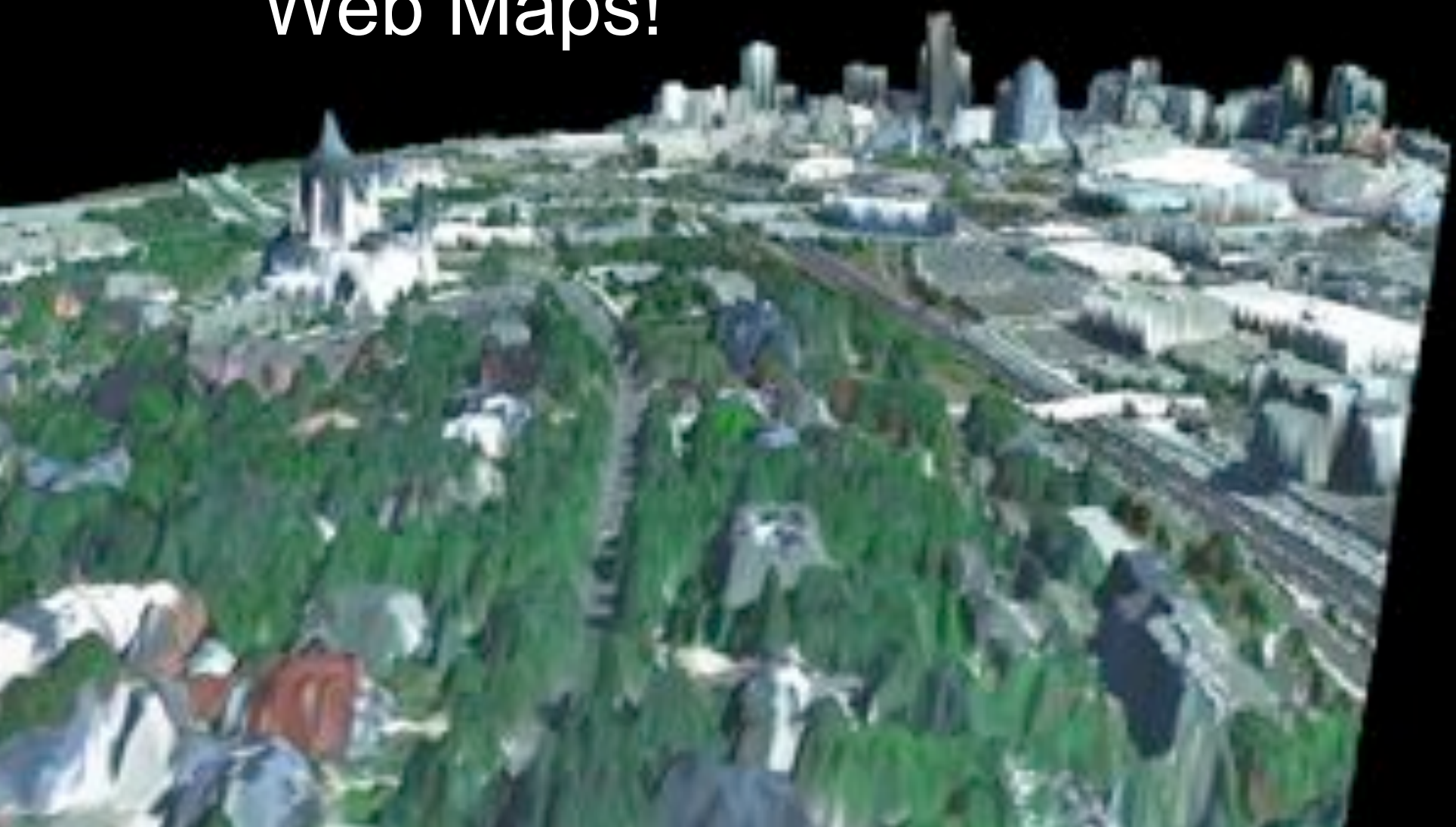
Aerial Photography
Date: Dec 30, 2005

Wetlands are 4 Dimensional



Start Thinking 4D

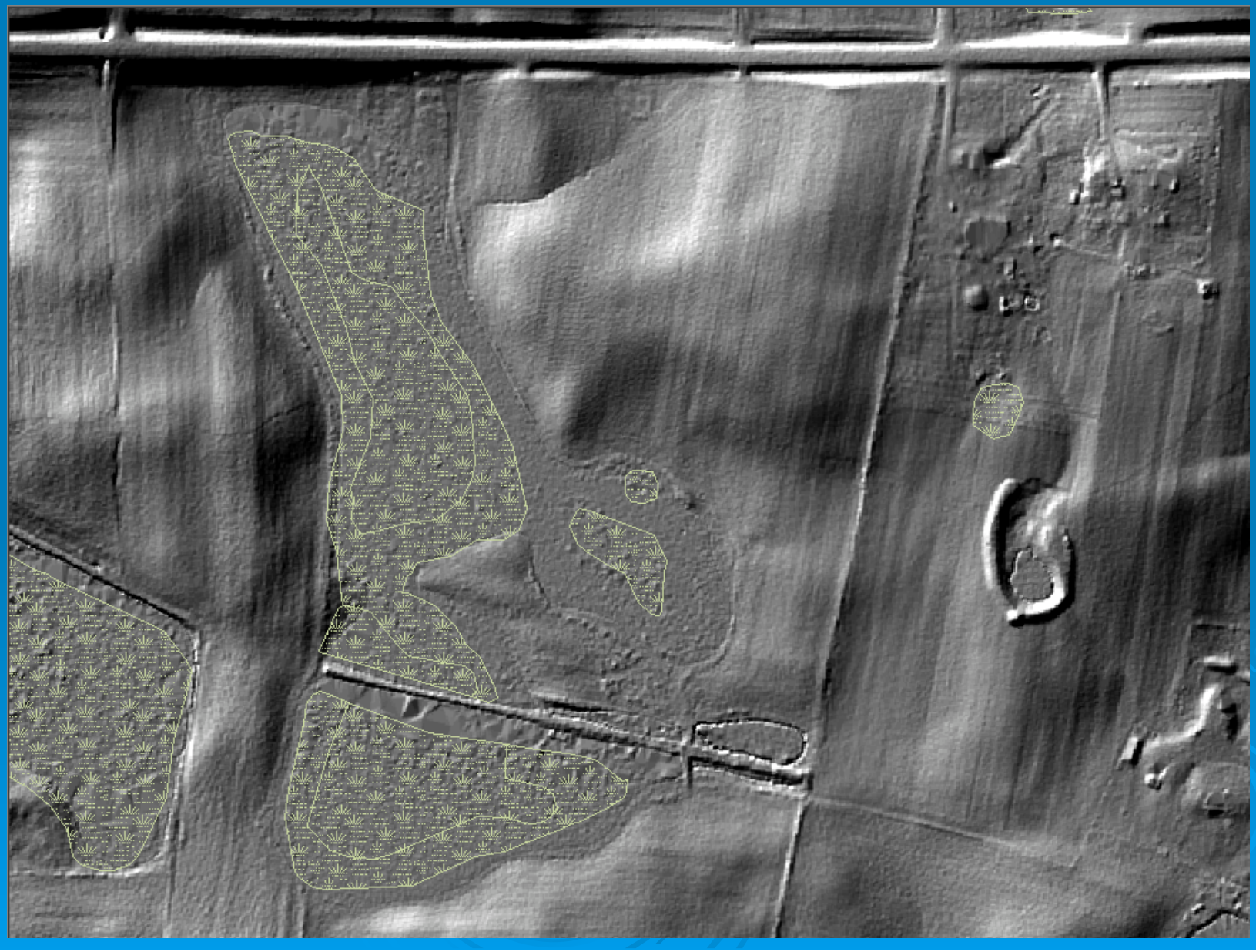
Raster Vector Integrated
Web Maps!



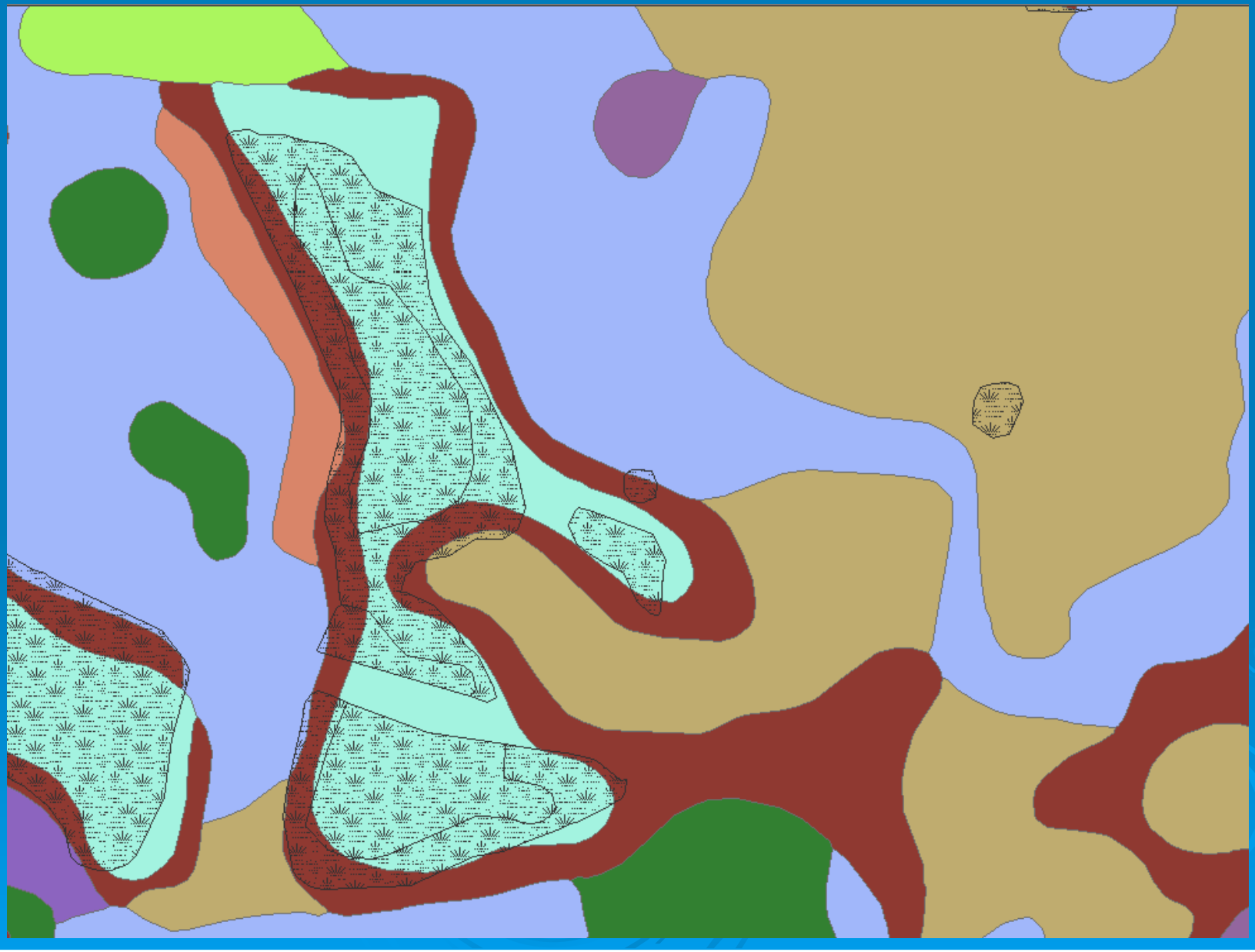
Use Multiple Data Sources

- Original NWI
- Aerial Photography (DOQs)
- LIDAR/IFSAR Topography
- Soil Surveys (SSURGO)
- Hyperspectral Imagery
- Multi-Spectral Imagery
- Thermal Imagery
- Radar Imagery

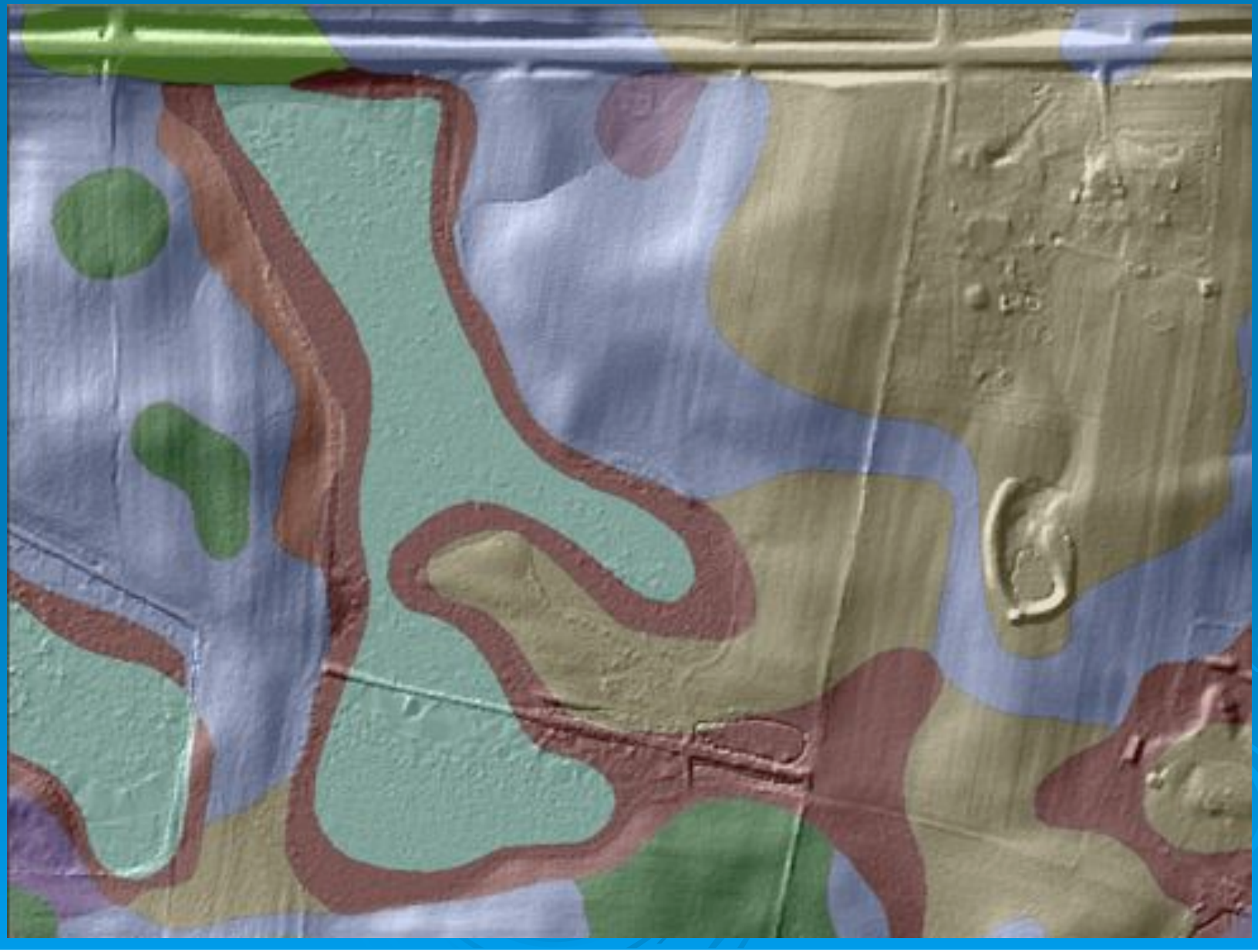
Topography

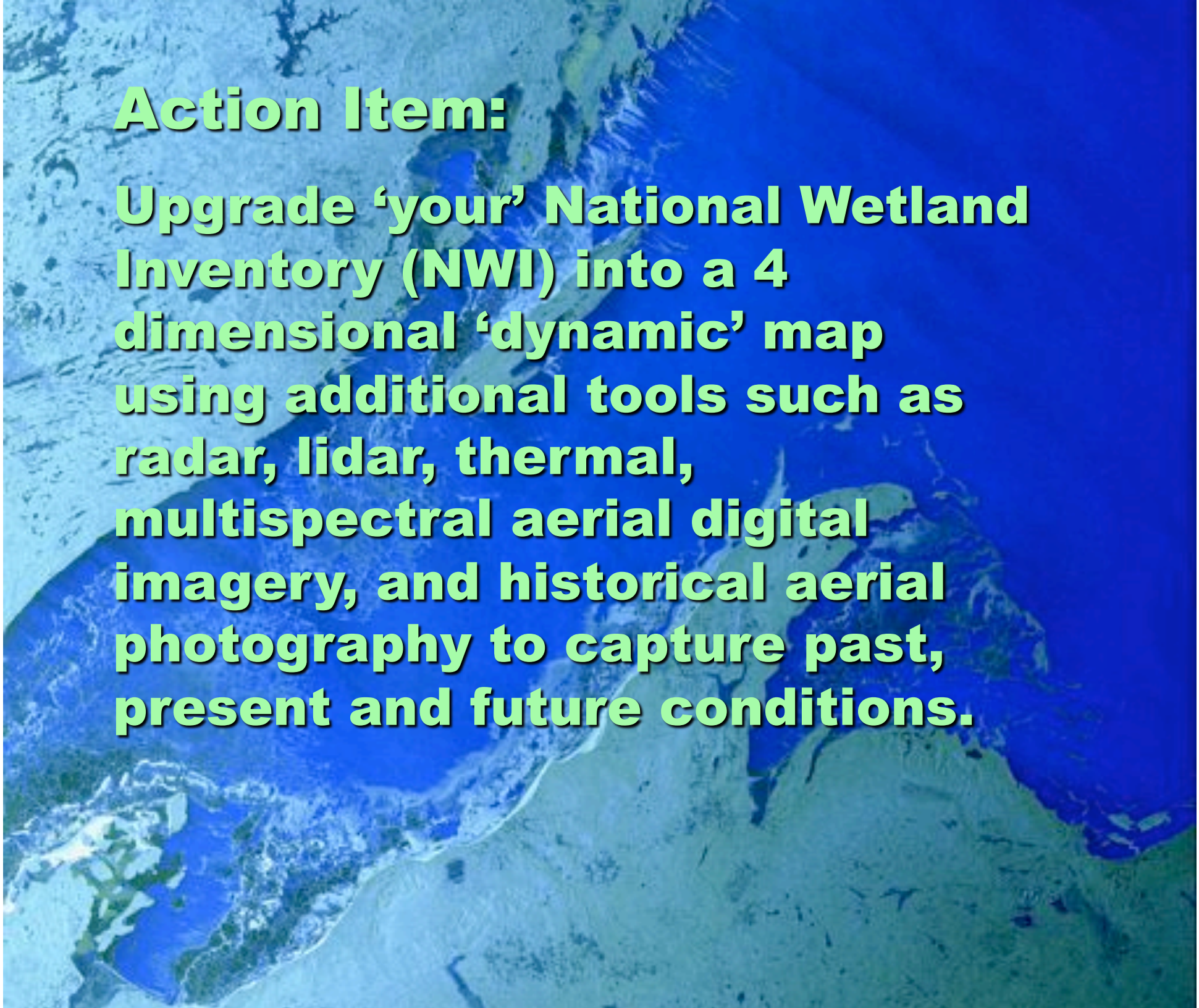


SSURGO Soils



Integrating Data – to 4D product




Action Item:
Upgrade ‘your’ National Wetland Inventory (NWI) into a 4 dimensional ‘dynamic’ map using additional tools such as radar, lidar, thermal, multispectral aerial digital imagery, and historical aerial photography to capture past, present and future conditions.

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651/259-5164

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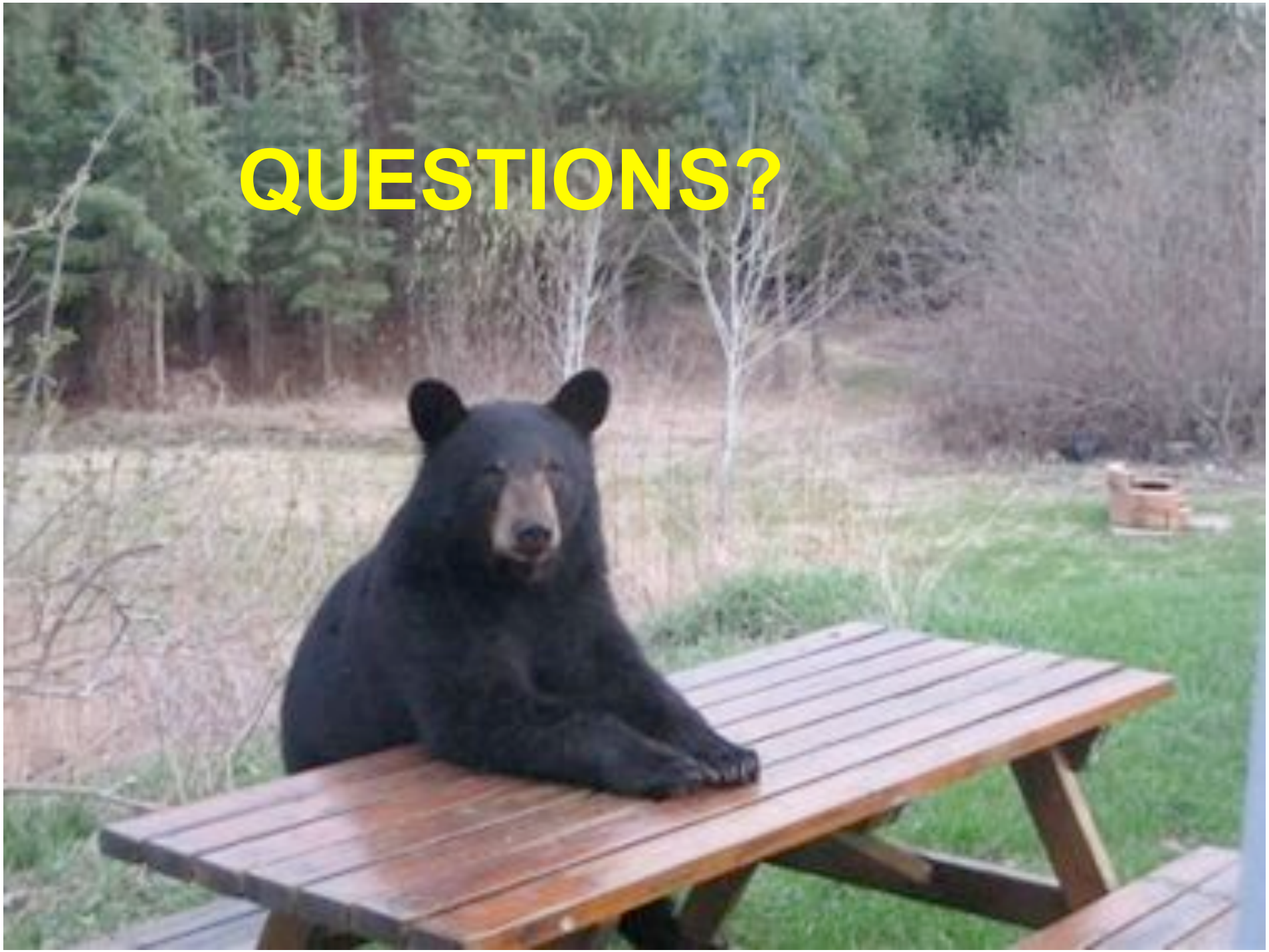
  - Richard Powell, MTRI


QUESTIONS?